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FOOD STORAGE AND TRANSPORT

THE problems of storage and transport of food have troubled men ever since they began to crowd into cities and to attempt to live at any density in northern latitudes. A diet of the cereals that made these developments possible is obviously monotonous ; less obviously, but as inevitably, it is inadequate to maintain health. The three chief deficiency diseases that are recorded as causes of deaths—scurvy, beriberi and pellagra—are associated with diets consisting too exclusively of the three great cereals—wheat, rice and maize. In England scurvy was common until the introduction of potatoes and root crops, which supply vitamin C directly to human beings, or feed animals that will provide fresh meat and milk.

War brings back the old problem in an acute form. Armies are transported to places where they cannot get fresh food, and civil communities are cut off from their normal supplies. During the War of 1914–18, in spite of the relatively high standard of nutrition maintained and the recognition of the relation of these diseases to diet, British troops in Mesopotamia suffered from scurvy and beriberi, and small epidemics of scurvy appeared in Britain when potatoes were scarce in 1917. When the diet is uniform and monotonous the effects of any deficiency become cumulative ; hence the frequency of beriberi in prisons and asylums. Soldiers and others who live on fixed rations, if these are not soundly planned, are liable to deficiency diseases ; while civilians, though their food supply may be less well cared for, escape because they get a greater variety of diet and may protect their health by what may appear to be extravagances and indiscretions. The rations of British troops[1] in the Mediterranean in 1915, and even the diets of Armenian refugees at Port Said[2] in 1916, would have seemed luxurious to German civilians in 1917 ; but the soldiers got beriberi and the refugees pellagra, while the Germans suffered from neither.

The more the exigencies of war limit our food supply the more should we aim at maintaining a variety of foodstuffs and insist that these should keep their full nutritive value. We should not depend on supplements of vitamins. The diets given to British soldiers in the Mediterranean area during the 1914–18 period were planned on the basis of knowledge as it had stood a few years before ; but they proved deficient. It would be presumptuous to assume that we now know the whole range of our nutritive requirements and that a diet made up artificially, on the basis of knowledge as it stands now, would be complete. We must still depend on natural foodstuffs for our nourishment and use vitamin supplements only as a last resource.

Two vitamins, obviously, need to be considered—A and C ; for the supply of vitamin A is reduced by the loss of imports of butter (33 per cent of the supply in 1938 came from areas now in enemy hands) and that of vitamin C by the restriction of the imports of citrus fruits. We depend mainly on vegetables to make up the lack of these two vitamins. In the early

months of the year, when green vegetables are scarce, supplies of both fall below the amounts considered necessary. Preserved vegetables would help us to tide over this period. Soldiers who have to depend on food transported from a distance are liable to go short of vitamin C at all times of the year, and they may get little vitamin A from sources such as butter; preserved vegetables that retain their vitamins are therefore a necessary part of their rations. Apart from these more obvious examples, the supplies of nicotinic acid, riboflavin and animal protein are reduced by the shortage of meat. We should, therefore, aim at conserving these two vitamins and the biological value of proteins in any foods that are preserved.

The conditions of the present War modify the problem; they enhance the importance of transport as compared with storage. Owing to difficulties of shipping, weight and bulk must be kept to a minimum. So far as the supplies of the people of Great Britain are concerned, one solution is to limit imports to foods, such as wheat, that contain little water, and to produce the perishable foods at home. But this does not solve the problem of the soldier abroad, who depends on shipping for the whole of his rations. However, half or more of the weight of most of the perishable foods is made up of water. If this could be removed the tonnage required for their transport would be correspondingly reduced. We need, therefore, a method by which foodstuffs can be dried, without loss of their nutritive properties, rather than preserved in other ways such as canning.

Attempts have been made, from the earliest times, to preserve the perishable foods, more in order to provide variety than to safeguard health; but these attempts were not wholly successful; the products were not even palatable. In England the stored meat became high during the winter; strong spices were needed to mask the taste and prodigious quantities of beer to wash down the spices. The vicious tradition of strong sauces and pickles and the less noxious habit of copious beer drinking had once their justification. During those phases in the history of scurvy in which the relation of the disease to lack of fresh fruits and vegetables has been accepted, efforts have been made to prepare dried vegetables for use as antiscorbutics. During the War of 1914–18 the only vegetables in the rations of the Austrian army were dried by a process in which an influential personage had an interest. They were popularly known as "barbed wire"; the discontent caused by these bad rations contributed much to the collapse of the Austrian army. All attempts at the preservation of fresh vegetables failed for reasons that we now understand. The processes of canning fruits, by which some of the vitamin C is preserved, were developed in order to provide variety; the improvements of the commercial processes, which ensure that very little of the vitamin C is destroyed, have been dictated more by the desire to preserve the flavour than by any thought of nutritive value.

The present need to economize shipping has stimulated new efforts to preserve foods by drying without loss of palatability and nutritive value. The methods have made use of recent discoveries in connexion with the loss of vitamin C in cooking. Until a few years ago, it was thought that the vitamin C in vegetables is destroyed rapidly when these are heated in presence of air, in the same way as it is in simple solutions. It was therefore natural to suppose that the best way of drying vegetables would be to freeze them and then evaporate water under reduced pressure. The product obtained by this method is bulky, and owing to its open structure very susceptible to the water vapour of the atmosphere. It is now realized that the ascorbic acid is more stable when in plant tissues; but that an enzyme present in the cells destroys the ascorbic acid when the tissues are damaged by bruising or by heat. The main lossess in cooking are due to three processes: first, the action of the enzyme during the period that elapses after the heat damages the cells and before it destroys the enzyme itself; second, the extraction of the ascorbic acid by the water in which the vegetable is cooked; and third, and least important, destruction by heat and oxidation, without the assistance of the enzyme, as in simple solutions. Losses in cooking can be reduced to a minimum by heating up the vegetable rapidly to boiling point, in order to give the enzyme little time to act, and by using cooking water repeatedly so that the concentration of ascorbic acid in it approaches that in juices of vegetables. In the same way, the losses in drying are due to the action of the enzyme.

The extent to which modern knowledge has been foreshadowed in the past is remarkable. For not only had the essential role of fresh fruit and vegetables for the prevention of scurvy been demonstrated and forgotten repeatedly up to 1916, but so far back as 1757 Lind wrote that when the Lords of the Admiralty proposed that dried vegetables should be tried as antiscorbutics "it was objected by the very ingenious physician [Dr. Cockburn] that no moisture whatever could replace the natural juices of the plant lost by evaporation and, as he imagined *altered by a fermentation that they underwent in drying*". Change "fermentation" to "enzyme action" and the words of the very ingenious physician might be written to-day.

If vegetables are first scalded rapidly, the enzyme is destroyed and they can then be dried in a current of air, without special precautions save that the temperature should not rise above 80° C. Vegetables dried in this way and later cooked contain as much ascorbic acid as do cooked fresh vegetables. Loss of carotene (which is the precursor of vitamin A) can be avoided. Meat treated by preliminary short cooking loses none of its nicotinic acid and riboflavin. From the point of view of nutritive value the difficulties of drying have been overcome. Yet people will not eat foods, however great their nutritive value, if they are not as palatable and attractive in appearance as those with which they are familiar. Many families in Great Britain have gone short of animal protein this year, although they could get unlimited supplies of skim milk powder. Fortunately, palatability and appearance seem to run parallel with nutritive pro-

perties. The preserved vegetables are eaten as readily as fresh, and dehydrated meat will serve one of its most important functions in modern diets—that of providing flavour. As ascorbic acid can be estimated without difficulty, it should be possible to guarantee the general qualities of dried vegetables by insisting that they should contain specified amounts of ascorbic acid. The new method is commonly called dehydration to distinguish it from the old drying processes in which nutritive value was lost.

It is probable that the drying plant in Great Britain, in the immediate future, will be no more than sufficient to meet the needs of troops. It is to be hoped that, at some time in the future, it will be possible to use dried vegetables to add to the civilian supply of vitamins C and A during the early months of the year. The process seems so simple that it should be possible to make an efficient domestic dryer. Storage in air-tight receptacles should not be necessary, as the dried vegetables keep their ascorbic acid for some months when exposed to air.

After the armistice of 1918, the great shortage of shipping and the crippled state of the railway systems of Europe hampered and delayed the relief of the urgent scarcity of food east of the Rhine. When hostilities again cease, the available shipping will again be insufficient, the railway systems more severely damaged and the need for food will be even more serious. The difficulties of transport are recognized as one of the obstacles to the relief of famine. The diets recommended by the Health Organization of the League of Nations[3] for famine relief are made up of dry foods, cereals, milk powder and cod liver oil; they do not provide vitamin C. Dehydrated foods should be most valuable in supplying a more satisfactory diet.

When the urgent demands of famine relief have been met, a new problem will arise if our promises are taken seriously. We have guaranteed that no one in any part of the world shall suffer from want. It should be comparatively easy to ensure that no people go in want of food energy. In peace-time there is no gross shortage of food energy, when crops are normal, in any part of the world. An International Famine Prevention (not Relief) Organization could keep a watch on crops throughout the world and keep a stock of cereals that could be shipped to any area where a bad crop was anticipated. But it is perishable foods which are scarce. The best final solution would be that some of these perishable foods should be produced in countries which are specially suitable, and transported to other parts of the world, while a considerable proportion should be produced where consumed. This local production is both convenient and economical, as one-type agriculture is in the long run unsound. But it involves the reorganization of agriculture and a redistribution of the population of the most congested areas.

This will all take time, and in the interval these perishable foods must be imported from other countries in some form suitable for transport; again, dehydration should lessen the difficulties of the task. The production of the quantities of those foods that will be required will involve an enormous expansion of plant, and this expansion will raise problems of materials and labour, which will have to be apportioned between these and other projects. This process of reconstruction will involve a gigantic co-ordinated scheme, and it will come to nothing if it is not thought out beforehand. No speeches, declarations or charters will, by themselves, make the fruits of the earth fall into the lap of the Indian coolie or even of the peasant of south-eastern Europe.

[1] Med. Res. Council, Special Report, **167**, 248 (1932).
[2] Wilson, W. H., *J. Hyg.*, **20**, 1 (1920).
[3] *Bull. Health Org.*, **7**, 677 (1938).

MAN'S RELATION TO THE LIVING WORLD

The Discipline of Peace

By K. E. Barlow. Pp. 214. (London: Faber and Faber, Ltd., 1942.) 8*s.* 6*d.* net.

THIS stimulating little volume makes an admirable complement to Lewis Mumford's "Technics and Civilization", which contains indeed the essence of Dr. Barlow's argument. Whereas Mumford is concerned primarily with the effect of the machine on man and how man is to regain control over mechanization, Dr. Barlow's approach is from the biological side, and he is concerned with the effect of man's interference with the balance of Nature. The importance of these ecological considerations, alike for our war effort and for post-war reconstruction, is slowly being realized, and Dr. Barlow's volume should materially assist that process of education.

The main argument of the book is that since man lives by the living balance of Nature—soil, plant and animal woven together in a vast balanced system—it is important that man should ascertain how his own character is related to the rest of life and how his machines link up with it. Only against this background can our essential social problems be understood. Justice and the association of man with his fellows in a commonwealth of peace are only possible when an attempt is made to administer the commonwealth of mankind for the benefit of mankind. If man is to enjoy the fruits of his estate, he must first recognize what is due to the natural world by which he lives, and become the responsible manager and administrator of Nature and no longer the mere exploiter.

It is one of the tragedies of the present situation that just when the ecological argument which Dr. Barlow ably sustains in his chapter on soil erosion is becoming more widely appreciated, the exigencies of total warfare are leading to further exploitation of natural resources and disturbances of the balance of Nature on a scale and in terms of a short-range policy, which it may take the work of generations to repair. On the other hand, as Dr. Barlow points out, the change back from war economy to peace economy fortunately involves an inevitable reorganization of industry which may well give us the opportunity to strike a new balance between industry and agriculture, though it would be rash to assume that the implications of the reactions of food, flood and agriculture are as yet fully or widely grasped. That is an essential preliminary to the development of the adequate organization, and the recognition in a

number of recent reports on reconstruction of the importance of a balanced relation between agriculture and industry is at least a hopeful sign.

The value of Dr. Barlow's volume at the present time lies also, however, in his lucid exposition of what is involved in any policy or programme for reconstruction. He brings us face to face with the permanent conditions of politics—the laws of the relation of man to his environment which political philosophy and social planning have tended to ignore. Man's first peace problem is to secure the conditions which will make it possible for him to live at all, and one of the first aims of a wise peace conference would be the restriction of the trade of agricultural peoples to the limits imposed by the balance of Nature, even although this involves a change in the social organization. The idea that agricultural practice must be increasingly modified by the need for protecting soil and vegetation is forced on us not merely by considerations of town planning or location, but also by the primary instinct for survival.

Granted that man must increasingly co-operate with, instead of exploiting, Nature, and that the prospects of peace depend ultimately upon human understanding and effort and sufficient humility and determination to work tolerantly with the processes from which our well-being derives, something approaching a revolution in thought will be required before the great industrial nations will accept not merely the discipline of personal behaviour but also the shrinkage in industrial activity involved in the organization of a new economy in which industry is no longer an orgy of exploitation but a limited and balanced organ in the kingdom of life. Dr. Barlow's exposition of what is involved in regard to international trade between industrial and agricultural communities should bring home to every reader how far we yet are from being able to attempt to lay down the blue prints of a new order which could claim to be durable.

This realistic approach is not Dr. Barlow's only claim upon the attention of the scientific worker. In his argument he links together the ideas of discipline and peace—so often mistakenly regarded as opposed—and brings us to face the imperative necessity for a faith or philosophy for living. Discipline has too long been despised as a military or slave virtue, and the fact that it is one of the fundamental virtues, close to the core of Christianity itself, without which civilization cannot survive, is commonly forgotten or ignored. Even Prof. Mannheim eschews the word in calling for the elaboration of a new and dynamic conception of both freedom and discipline in social reconstruction.

There are healthy signs in the growing recognition that there must be civic duties and responsibilities as a counterpart to freedoms and rights in a new order, that the emphasis must be on service owed to the State rather than on rights conferred. Dr. Barlow's description of discipline in what may be termed the professional or scholarly sense of the word, the self-restraint and conformity which must be accepted by any disciple or recruit in a skilled or learned occupation, cannot but induce the reflection that we have yet much to learn before we acquire the technique and discipline essential to the building of an ordered world, dynamic not static, and free from the strains set up by lack of balance or disequilibria. In Dr. Barlow's view, the higher social and political activities of man are a further elaboration of the processes in Nature in which, as we pass from plant to animal and to man, the characteristic discipline of each is elaborated and interwoven with the disciplines which preceded it, and their understanding is equally relevant to the problem of providing in human society the conditions of peace.

In his attempt to point the way to an adequate philosophy, Dr. Barlow is less successful than in his ecological analysis, but none the less his book is a fine challenge to the fundamental thinking that must precede any real reconstruction. The absence of such a philosophy is largely responsible for unco-ordinated, destructive and unsatisfying energies. If man with his formidable powers wishes to live at peace in the world, it is essential that his knowledge should be an adequate guide for his acts, and nothing but positive articles of faith will be of value to us. Our task is to understand how conflict between man's initiative and that of Nature can arise: on this question of the relation of knowledge and action, Dr. Barlow's point of view is suggestive and to many scientific workers, if not novel, at least unusual. Modern activity is based on science, but pointing out that science, which is merely the elaboration of a faculty which man has always possessed even if in rudimentary form, should not be blamed alone because man interferes with the detail of his surroundings without heeding the archetypal pattern into which that with which he interferes is gathered, Dr. Barlow insists that what is new in the scientific civilization is the complete separation of the manipulative from everything else, including the archetypal organization of Nature. While greatly increasing the scope of the manipulative technique of science and extending the range of man's own physiological performance, this has also released manipulation from the major discipline of Nature.

To strike a balance between these major disciplines of life—that of Nature on one hand and of man and of his manipulations on the other: is one of the major problems to be solved if man is to regain control of the machine which is the immediate social consequence of his use of science. A new conception of machine organization is a first preliminary to a stable world order. The over-riding prerogative of the machine must be replaced by a balance and an integration with the other factors in the biological hierarchy, in which not merely the physical and physiological needs of man but also his cultural, social and spiritual needs are satisfied.

Dr. Barlow does not conceal the difficulties which will be encountered in the practical application of the ideas for which he argues so cogently. The co-ordination of our machines with the other phases of natural and social life, for example, is an urgent aspect of replanning our cities. On the other hand, he makes equally plain the dangers to essential liberties inherent in present attempts to make man's actions fit an industrial system instead of allowing him to recognize his natural relationship and the importance of reconciling the discipline which is necessary to society with the preservation of the qualities of the citizens who come under that discipline.

The book is a courageous attempt to see life steadily and to see it whole, and to envisage the action which must follow as we come to understand the discipline under which we must live. Here is no flinching from consequences but a challenge to both thought and action. The price of liberty in a social system is the display by the management of the community of the powers of combination and order which are char-

acteristic of life. Man's freedom to understand his situation must be absolute, but the primary issue is not how we are to treat materials but how men are to treat each other and the life of the earth which endows them. To realize the full potentialities of an ordered freedom within the delicate structure of life, we must first create within the wide estate of Nature the conditions which that freedom implies and demands. Whether or not we agree with all Dr. Barlow's conclusions, no one can question the sincerity or the dignity of this call to the fundamental and creative thinking on the adventures of ideas out of which alone we can hope to build a social and an industrial order which will serve man's twin desires for order and for growth. R. BRIGHTMAN.

BIOLOGY OF THE CUCKOO

Cuckoo Problems

By E. C. Stuart Baker. Pp. xvi+207+12 plates. (London: H. F. and G. Witherby, Ltd., 1942.) 25*s*. net.

THIS is the most exhaustive work on the biology of the cuckoo that has yet appeared. The author's qualifications for writing it are unique, for not only has he studied the habits and economy of birds of this family for nearly seventy years, but also he has obtained far and away the most complete collection of cuckoos' eggs, together with the eggs of their fosterers, that has ever been got together, for practically all the known genera, species and races of Europe and Asia are represented, besides some from other countries. Moreover, the work of other investigators is not neglected in discussing the various problems dealt with in this book.

The first part deals with the necessity for cuckoos' eggs being adapted to those of their fosterers. Mr. Baker's evidence clearly shows that the owners of the selected nests often display discrimination, for they may either desert the nest in which the cuckoo's egg has been deposited, or they may eject the egg or in some other way destroy it and so prevent it being hatched. Such discrimination has resulted in the evolution of adaptation between the eggs of the cuckoo and those of their fosterers in size, colour and general appearance. Since individual cuckoos normally keep to the same foster parent, there comes to be a close resemblance between the eggs of the parasite and those of the dupe. Thus, the case would appear to be one of simple Darwinian selection. The evidence for all this is very fully set out, not only for the common cuckoo, but also for other species and varieties of Cuculidæ, and Sir Edward Poulton in a foreword fully endorses Mr. Baker's conclusion. The beautiful coloured plates which are reproduced from Miss Edna Bunyard's original drawings showing the types of eggs of various kinds of cuckoos, together with the eggs of their respective fosterers, add to the value of the treatise.

In the last chapter dealing with adaptation, the author discusses the origin of the parasitism, and points out that the habit of laying eggs without nests was probably primitive in birds, being normal in their reptilian ancestors. Hence the practice of so many cuckoos may be regarded as being partly of the nature of a reversion to a state when birds laid their eggs in various places without making nests.

The next part of the book deals with the question as to how the cuckoo deposits its egg in the fosterer's nest. The author accepts Chance's evidence as proving beyond contention that cuckoos very usually lay their eggs in open nests, as do so many other birds, but without the cuckoo placing its feet and weight upon the other eggs. In other cases, however (as with some cuckoos in India), the eggs may be projected into nests within holes which the cuckoo cannot enter. Further, in addition to these two proved methods, the author thinks that there is a third way whereby eggs are placed in nests in which they can be neither laid nor projected, and he discusses the evidence for the old assertion that the bird may lay its egg on the ground and then carry it in its beak. Without coming to any definite conclusion, Mr. Baker is of opinion that this method is adopted in cases where the bird could not insert its egg in any other way. This probably happens sometimes with the plaintive cuckoos of India and with some other species.

The last part of the book treats of other cuckoo problems such as territories, the ejection of fosterer's eggs and young, numbers of eggs and provision of nests before laying, and the evidence in all these matters is fully given. The author states that with all the species of Cuculus the eggs are laid at intervals of forty-eight hours, once the process has started. The number of eggs is usually from twelve to eighteen. It is very unlikely that the eggs are fertilized in the ovaries, as the author appears to assume, for the observations of Warren and Kilpatrick clearly indicate, as pointed out by Hartman and Hammond, that in the fowl the gametes unite at the anterior end of the oviduct. In the turkey and various other birds (and possibly in most or even in all) the eggs of the entire clutch are fertilized as a result of one treading, so that the spermatozoa must survive for twenty to thirty days within the body of the hen. In gallinaceous birds, however, ovulation takes place spontaneously, whereas for most other birds there is general evidence that the first ovulation does not occur without coition, or in any event without a stimulus from the male, and further, that the process in nearly all birds depends also upon the number of eggs in the nest, since it may be repeated many times if the eggs be removed. One would like to know if similar considerations apply to the cuckoo. The observations indicating that cuckoos are promiscuous suggest that they copulate several times during the short single breeding season. One would like to ascertain if the oviduct normally contains living spermatozoa through the whole period. The existence of suitable nests within the territory may well constitute the main stimulus for repeated ovulation. Assuming this to be so, when the cuckoo lays in the nest of an unsuitable fosterer such as the wren, or outside its territory, it is probably because the bird has already ovulated as a result of an earlier stimulus, and holds in the oviduct an egg that must pass out. The absence of available nests would presumably inhibit ovulation but not the actual laying, once the egg has left the ovary.

The book concludes with valuable appendixes containing data of the weights and measurements of eggs, dates of laying, desertion and rejection of eggs and various other interesting matters. It may profitably be studied in conjunction with Friedmann's book on the cowbirds and Davis's article on the American cuckoos of the sub-family Crotophaginæ, recently published in the *Quarterly Review of Biology*, in which similar problems are discussed. It is to be hoped that a new edition will be provided with an index. F. H. A. MARSHALL.

Genetics for Medical Students

By E. B. Ford. Pp. iv+162. (London: Methuen and Co., Ltd., 1942.) 7*s*. 6*d*. net.

THE publication of this competently written book which was prepared ostensibly for medical students is particularly opportune. In a straightforward and clear manner the author outlines the principles of particulate inheritance. The medical reader will be pleased to note that examples from man replace bottled Drosophila or wrinkled peas. After an adequate and clever account of Mendelism, which may surprise a pedantic geneticist, of linkage and the genetics of sex, there is a chapter on mutations and the nature of heredity. This chapter is a brilliant essay which will go far to counteract prevalent fallacies regarding the inheritance of environmentally influenced characters.

Other chapters on polymorphism, blending inheritance, gene action and blood groups answer many problems of the medical and sociological worker. The author suggests a useful nomenclature to clear up the muddle apparent in most accounts of the genetics of blood groups.

A chapter is devoted to methods which may be adopted in analysing the inheritance of characters in man. There are useful appendixes containing references for further reading, a list of inherited characters in man, and an account of mitosis and meiosis more than adequate for the comprehension of modern genetics.

This book fills a long-felt want by the medical profession and contains both simple descriptions of the fundamental principles of human genetics and illuminating passages of considerable thought and originality.

F. W. SANSOME.

The Statesman's Year-Book

Statistical and Historical Annual of the States of the World for the Year 1942. Edited by Dr. M. Epstein. Seventy-ninth annual publication, revised after Official Returns. Pp. xxxvii+1474. (London: Macmillan and Co., Ltd., 1942.) 30*s*. net.

THE revision of statistical information for many States of the world has been difficult and in some cases impossible, but nevertheless this annual volume contains all the latest figures for the British Commonwealth, the United States and other lands within reach, while for enemy lands, or enemy-occupied lands, figures are at least up to the date of enemy action and even later. The editor has retained the arrangement of States as in pre-war editions except that Estonia, Latvia and Lithuania are now included with Soviet territory. Abyssinia tardily remains within the pages of Italian colonies; Syria remains under French tutelage; but the position of States matters little; the factual information is the valuable side of the book.

It has been found impossible to include the usual tables of world production of various commodities, but two maps, as usual, are provided, one showing naval bases in the Indian and Pacific Oceans and the other the boundary settlement of this year between Ecuador and Peru. Under additions and corrections there have been inserted many facts about Canberra, the federal territory of Australia, and about recent social and economic changes in the authoritarian regime in France. The size of the volume is practically the same as in recent years.

The Philosophy of Edmund Husserl

The Origin and Development of his Phenomenology. By E. Parl Welch. Pp. xxiv+337. (New York: Columbia University Press; London: Oxford University Press, 1941.) 22*s*.

EDMUND HUSSERL died in 1938 at the age of seventy-nine. His writings have had considerable influence on the Continent, but not much in English-speaking countries. He was mainly concerned to give an adequate account of the nature of experience, as that behind which we cannot go and upon which all belief and action are founded. Husserl considered experience to be self-revealing, so that careful attention to what is present to the mind is all that is needed and indeed possible; provided that experience is understood in its full sense, as that which is lived through and directed towards something, not taken partially and incompletely as a collection of 'sense data' after the manner of the Positivists. Like many thinkers, especially German ones, Husserl, having got hold of one good idea, runs it to death by expecting it to do the work of a whole philosophical system. He seems to have thought he was rescuing philosophy from a false psychology, but it is possible that his real merit has been to inspire the Gestalt School of thinkers to help to rescue psychology from a false philosophy. In this matter, however, it is doubtful whether Husserl's attempt at a comprehensive system has done more than the tentative efforts of his teacher Brentano.

The author of this book has tried conscientiously to expound Husserl's thought in clear and intelligible English, and also to compare it with some other types of philosophy. He has supplied an extensive bibliography and some useful criticism of other thinkers, but, for the rest, Husserl remains obscure and only partly intelligible. The fault does not appear to lie with the expositor. A. D. R.

Electrical Engineering

By W. Tolmé Maccall. Vol. 2. Pp. viii+463 (London: University Tutorial Press, Ltd., 1942.) 15*s*.

THIS book, combined with vol. 1, "is intended to cover the fundamentals of all branches of electrical-engineering dealt with in the usual three years day courses". The intention is an ambitious one, and, while the book compares very favourably with others of a like nature, it is not surprising that the result is a superficial treatment of doubtful value to the serious student. It is to be hoped that the average undergraduate is given a deeper insight into the fundamentals of the subject than is provided by the author. The book could have been improved considerably in this respect by the exclusion of those topics which it has not been possible to deal with adequately, of empirical data, constructional details and illustrations, experimental tables, etc., and the real scope increased correspondingly by deeper inquiry into the physical principles underlying the operation of the apparatus and equipment discussed. One of the primary aims in teaching should be to stimulate critical analysis and flexibility of outlook, and the author's treatment of the subject is unlikely to assist materially in this direction. The task attempted is made difficult by the rapid growth of the subject, and in these circumstances it is questionable whether any really useful purpose can now be served by books of this 'comprehensive' type.

DRIED FOODS

At a joint meeting of the newly formed Nutrition Society and of the Food Group of the Society of Chemical Industry, held in the Great Hall of the British Medical Association on July 25, a series of papers was devoted to giving an account of the results that have recently been achieved in improving the quality of dried foods. The meeting was private, several hundred members being present. In the morning the chair was taken by Sir Edward Appleton, secretary of the Department of Scientific and Industrial Research, and in the afternoon by Dr. H. E. Cox, chairman of the Food Group, deputizing for Dr. L. H. Lampitt of Messrs. J. Lyons and Co. Ltd., who was unfortunately prevented from being present.

In introducing the morning session, Sir Edward Appleton told the meeting how the Food Investigation Board of his Department, under the chairmanship of Sir Joseph Barcroft, had realized the tremendous importance which must attach to the utmost economy in transport of foodstuffs, particularly overseas transport, under war conditions, and had been concentrating for some time on dehydration. It has been estimated that in peace-time we imported every year as much as three million tons of water with our foodstuffs.

He thought that history would show that science had made tremendous contributions in the present War and that these contributions had been made largely by anticipating needs. It was quite possible that the work that had now been done on dried foods would be far from the least of these. It had been realized that the nutritional quality of dried foods was of critical importance and the Medical Research Council had collaborated on this aspect at the Dunn Nutritional Laboratory, Cambridge. The work had been organized by Mr. Eric Barnard, director of food investigation, and carried out chiefly at Cambridge under the scientific leadership of Dr. Franklin Kidd, of the Low Temperature Research Station.

In an introductory paper covering all commodities, Dr. Franklin Kidd pointed out that fundamentally no new discoveries had been made but that, nevertheless, by bringing together what was already known in other branches of the food industry and applying the results to dehydration, it could now be said, in general, that the nutritive quality and palatability of dried foods such as meat, fish, milk, eggs and vegetables would be equal to that of those preserved by the established processes of canning and refrigeration. The main principles which had in general to be observed were to destroy the enzymes by a short heat treatment before drying; to maintain a low water content in the dried product during storage and distribution, which can only be done by shielding it from contact with air; to exclude oxygen or retard oxidative changes by the use of antioxidants and avoidance of contamination with traces of metal; to avoid temperatures during drying above a certain limit which can easily be determined for any product, but nevertheless to dry as quickly as possible; to avoid temperatures during drying at which bacteria will flourish; and, lastly, to select the best material as regards flavour, appearance and nutritive value and to treat it with scrupulous cleanliness during the manufacturing operations. We could not hope for good dried foods if drying were used as a means of disposing of fresh food which had deteriorated too far for distribution in the fresh condition.

As an illustration of the economy in space and weight Dr. Kidd stated that the requirement for a full normal dietary consisting of flour, biscuits, cereals, potatoes, vegetables, pulses, meats, soups, fats, sugar, eggs, fish and milk, in the requisite proportions and including packaging, would reduce to a quarter of its weight and volume.

Dr. E. C. Bate-Smith, Miss E. M. Cruickshank and Dr. J. G. Sharp described fully the process for the drying of meat in the form of a mince which, for storage and distribution, is compressed into blocks and packed in air-tight cans. It had been found that the digestibility of this meat was unimpaired and that when the drying was carried out between the temperatures specified (60° to 80° C.) there was little or no loss of vitamin B_1 during drying, nor was there any loss of nicotinic acid or riboflavin. Vitamin B_1 is also retained during storage, but the retention of nicotinic acid and riboflavin has not yet been investigated. The fat content of the dried meat was 30–45 per cent on a dry weight basis.

As regards egg it had been found that little denaturation and coagulation of the protein occurred in spray-drying if the temperature of drying, as measured by the outlet air temperature, did not exceed 70°. No loss of vitamins A and D was observed during the drying. There was a loss of 30 per cent of the vitamin B_1.

What was particularly aimed at both with regard to meat and egg was the full retention of the characteristic flavour, odour, colour and appearance of the fresh food. Quality grading was therefore being carried out by a system of tasting panels which have proved unexpectedly simple in operation and capable of repeating judgments with consistency and accuracy. Surveys had also been carried out to ascertain the sensitivity of the average consumer to unit differences on panel scoring and, for immediate purposes, the level of what may be described as public acceptance has been ascertained. If dried meat and dried egg are protected from the access of air and the uptake of water, they can be stored for long periods without loss of quality.

Dr. G. A. Reay of the Torry Research Station described the roller-drying of minced fillets of raw cod, haddock and whiting in about a quarter of a minute to a water content of 8 per cent. A better product was produced by mincing pre-cooked fish and drying on trays between temperature limits which have been determined. With both fish and meat it is preferable to mince after cooking, that is, following the natural shrinkage which occurs after coagulation has taken place.

Dr. R. J. L. Allen, Dr. J. Barker and Dr. L. W. Mapson described in detail the process of drying cabbage, carrot and potato. Each of these vegetables must be given a heat treatment ('scalding') before being dried and, for the protection of the ascorbic acid from oxidation, the addition of a small quantity of sulphite to the scalding liquor is very beneficial. The reconstituted and cooked dried cabbage and potato should contain at least 35 per cent of the ascorbic acid of the raw vegetable, which is as much as, or more than, is retained when fresh vegetables are cooked. There is practically no loss of carotene during scalding, drying or reconstitution and cooking.

While storage of the dried product in air, but at low water content, is possible for reasonable periods with cabbage and potato, carrot should always be stored in an atmosphere free of oxygen owing to the destruction of carotene by the oxygen.

In winding up the sessions, Sir Joseph Barcroft

spoke briefly of the possible effect of dehydrated foods on the trend of national life and policy. It was clear, he thought, that dehydration plant would have to be situated where the food was produced and that we must realize that, with the possible exceptions of vegetables and milk, the dried foods we obtained would, for the most part, be dried overseas. If dried foods had a future it would obviously have profound reactions on the organization of transport and distribution. It was well worth facing this problem now because it would be much more easily dealt with when industries largely wrecked could be reconstituted on new lines than when normal industries would have to be remodelled at considerable loss. In particular, he wanted British agriculture to take advantage of dehydration as a means of getting the maximum production in its natural season. If British agriculture seized its opportunity, he believed the producer of good food would benefit, although the producer of inferior products might rightly regard dehydration as something of a menace.

The quality of dried foods prepared by the methods now being employed was not only high but it was ascertainedly so by assay for palatability, vitamin content, etc., and hence could be guaranteed. This he considered most important from the point of view of efforts to raise the nutritional status of the population as a whole. It was already clear that the price of dried foods would not exceed that of fresh foods and might be less owing to economies in cost of distribution and saving of wastage.

While it was impossible in so large a meeting for discussion to go into any detail, several interesting points were raised. Mr. Nevill Wright and several other speakers stressed the need of urgency and asked for information as to what steps were being taken to push forward with production of dried meat and vegetables. The question was raised as to what were the most suitable types of plant for drying different foods and, in particular, stress was laid on the importance of the efficiency of drying in terms of fuel consumption.

In reply to these points Dr. Kidd and Dr. Bate-Smith stated that stress had intentionally been laid on the importance of the pre- and post-drying treatment of the products and of the temperature limits during drying rather than on the exact specifications of the plant to be used. It was felt, in general, that while some adaptations might be necessary, the drying of meat and vegetables would not necessarily call for completely new types of plant design. In terms of the value of the material the cost of drying was negligible.

Dr. Colgate wanted to know whether it was possible to dry eggs without losing their beating quality, which contributed much to the value of the egg in the baking trade. He had not found even the best spray-dried egg equal to frozen egg pulp. Dr. Bate-Smith said that even egg dried out in a vacuum in a frozen condition had lost its aerating power to about the same extent as the spray-dried egg powder. However, this loss of beating quality could easily be overcome by the simple device of beating at an elevated temperature, for example, 40°. Even really poor spray-dried egg powder would give good aeration if the temperature of beating was raised to 50° or 55°.

Squadron Leader Macrae described experiences in the Royal Air Force. From every point of view these new dried foods were what was wanted. The men liked them and trials had shown that they got more vitamin C from dried cabbage than from fresh. This was due to the fact that the cabbage was dried in such a way as to preserve vitamin C while at the same time destroying enzymes which caused the loss of vitamin C by oxidation during cooking. The foods were easy to prepare and transport and they offered variety.

Mr. Charley and other speakers stressed the importance of easily prepared foods as a factor in family life, while others directed attention to their advantage in communal and emergency feeding. Mr. McLellan wanted more information broadcast as to simple methods for home-drying as an additional means of saving garden and allotment produce for the winter.

During the midday break a buffet lunch was served, and cooked dried foods manufactured by the improved processes described were sampled. Those present thus had an opportunity of confirming the claims made as regards their palatability.

DIGESTIBILITY OF HIGH-EXTRACTION WHEATMEALS

By T. MORAN and J. PACE

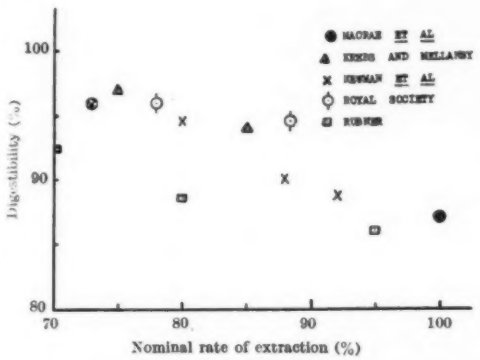
THE digestibility, in terms of energy, by human subjects of high-extraction meals (80–100 per cent extraction) is less than that of flour of 70 per cent or lower extraction. Recent work illustrating this is that of Macrae *et al.*[1], who compared 73 per cent flour with wholemeal (100 per cent), and Krebs and Mellanby[2], who compared 75 per cent flour with a sample of National wheatmeal (85 per cent). Unfortunately, there are no modern data on digestibility for meals between 85 per cent and 100 per cent. Older data exist[3], and it is usually the practice to make the rate of extraction the basis for the comparison of the results of different investigators. In the accompanying figure, these data are plotted in this manner and the wide variation in the results is immediately apparent. In this article we wish to emphasize that in digestibility experiments or calculations on wheatmeals the practice of making the rate of extraction the basis of comparison is fundamentally unsound and may give rise to misleading results and deductions even though the experimental technique of the test meals, etc., is completely satisfactory. At a given extraction the digestibility must depend also on the composition of the wheat grist, the conditioning of the wheat and the method of milling.

The wheat grain consists of endosperm, germ, seed coat (testa, hyaline and aleurone layers) and the shell or pericarp. The layers of the seed coat and pericarp together, with a varying amount of endosperm, constitute the bran; without the endosperm they can be regarded as 'pure bran'.

There seems little doubt, especially in view of the work of Macrae *et al.*[1] on wholemeal, that decrease in digestibility in passing from white flour to high-extraction meals is due to the presence of bran or bran layers rich in indigestible fibrous material. The pericarp or beeswing* includes the layers which

* Beeswing is a general term used by millers and may comprise the whole or part of the pericarp. The actual composition depends on the condition of the wheat and the point of separation in the mill flow; examination of one particular sample from the purifiers showed that it contained all four layers of the pericarp although the amounts of the two inner layers seemed to be slightly less in proportion.

contain the most fibre—two determinations gave figures of 21 and 23 per cent against 14 per cent for pure bran (see below)—and it is the presence of this fraction, either alone or in bran, which is mainly responsible for the lower digestibility of high-extraction meals. Our experience with National wheatmeal shows that the bulk of the contained bran particles are substantially full bran including the aleurone layer.



Fibre content is a sensitive index of the amount of indigestible materials in the bran or its separate layers. The size of bran particle has little or no effect[1]. The white flour basis itself has a small fibre content which is difficult to determine accurately but is in the range 0–0·2 per cent; much of this fibre will be from the cell walls in the endosperm. As we move beyond 73 per cent extraction the increase in fibre content is due mainly to bran or its components.

On the basis that the fall in digestibility is proportional to the fibre content it is possible to calculate theoretical digestibility figures for wheatmeals of different fibre contents. The wholemeal used by Macrae *et al.* had a fibre content (reckoned on a 15 per cent moisture basis) of 1·80 per cent and a digestibility of 87 per cent. The 73 per cent white flour used had a fibre of 0·15 per cent and a digestibility of 96 per cent. On the assumption given above it follows that each increase of 0·2 in fibre content (above 0·15) leads to a decrease in digestibility of about 1·1 per cent. Figures calculated on this basis are shown in Table 1.

TABLE 1.

Fibre content	0·35	0·55	0·75	0·95	1·15	1·35	1·55	1·75	1·95	2·15
Digestibility %	95	93·9	92·8	91·7	90·6	89·5	88·5	87·4	86·3	85·2

The only experimental figure available for checking this is that of Krebs and Mellanby[2], who found a digestibility of 94 per cent for an 85 per cent extraction meal which had a fibre content of 0·45. From Table 1 a meal with this fibre content has a calculated digestibility of 94·4.

It is also possible, taking average figures for the composition of the wheat grain—endosperm and germ 86–87 per cent; pure bran 13–14 per cent—to calculate a figure for the digestibility of pure bran. The figure obtained depends on the value taken for the digestibility of pure endosperm. It is most probable that this is in the limits 97–99 per cent. Taking these limiting figures, the digestibility of pure bran works out at 23 per cent and 11 per cent respectively. The fact that the digestibility of the crude fibre alone in wheatmeal bread is of the same order[1] suggests that the particles of bran pass through the gut substantially unchanged except that the attached endosperm and possibly the aleurone layer are digested. At the same time the vitamin B_1 contained in the bran (including that in the pericarp and testa) must presumably be available since, *in vitro*, it is extracted by dilute acid.

Commercially, bran consists of pure bran plus endosperm, and the digestibility of any commercial sample will depend on the endosperm content.

It is of interest to illustrate the points discussed above by two examples.

Example 1

Typical relative proportions of the various milling fractions and the fibre contents of these fractions have been published[4] (cf. also Table 2). From these data we can compound wheatmeals corresponding to different nominal rates of extraction as follows:

% *Extraction*

80% = 73(*a*) + 5(*e*) + 2(*d*)
85% = 73(*a*) + 5(*e*) + 2(*d*) + 5(*c*)
90% = 73(*a*) + 5(*e*) + 2(*d*) + 6(*c*) + 4(*b*)
95% = 73(*a*) + 5(*e*) + 2(*d*) + 6(*c*) + 9(*b*)
99% = 73(*a*) + 5(*e*) + 2(*d*) + 6(*c*) +13(*b*)

We can calculate the corresponding fibre contents and hence the calculated digestibilities. These data are brought together in Table 2.

TABLE 2.

Milling fraction	% of whole wheat	Fibre %	Rate of extraction %	Calculated Fibre %	Calculated Digestibility
Wheat	100	1·8			
(*a*) Flour	73	0·2	80	0·55	93·9
(*b*) Bran	13	8·0	85	0·90	92·0
(*c*) Fine bran	6	7·0	90	1·30	89·7
(*d*) Purifier tails	2	6·1	95	1·65	87·8
(*e*) Reduction roll tails and mill finish	5	3·6	99	1·80	87·0

Example 2.

Mr. A. G. Simpson has prepared a series of straight-milled high-extraction flours on the experimental milling plant at St. Albans. The grist contained 70 per cent No. 1 Manitoba and 30 per cent English and was milled at approximately 14 per cent moisture giving flours of approximately 13·5 per cent moisture content. The fibre contents of the wheat mixture and the flours were determined and these are shown together with the calculated digestibilities in Table 3.

TABLE 3

Flour or meal (% extraction on a clean wheat basis)	%Fibre (on a 15% moisture basis)	Parts of pure bran	%Digestibility (calculated)
75	Trace	—	97·0+
85	0·55	3·9	93·9
90	1·0	7·1	91·5
95	1·5	10·7	88·7
100	1·95	13·9	86·3

Samples of bran from three varieties of wheat all freed from endosperm by treatment with dilute lactic acid gave fibre contents ranging from 12·9 to 14·2 per cent (on a 15 per cent moisture basis). Similarly, for a wheat mixture of fibre 1·95 per cent (as in Table 3) and assuming it contains 13–14 per cent of pure (clean) bran, calculation gives the fibre content of the pure bran as 14·4 per cent. On the basis of an average fibre of 14 per cent, column 3 in Table 3 gives the equivalent parts of 'pure' bran in each meal.

An average composition of commercial bran (pure bran and endosperm) from wheat conditioned for the milling of white flour is given below together with an analysis calculated for pure bran. This can only be a proximate analysis because the endosperm attached to commercial bran is richer in oil, protein and ash than the bulk of the endosperm. Incidentally, it would appear that the amount of endosperm attached to the commercial bran was approximately 40 per cent; with the drier milling of National wheatmeal the amount of attached endosperm will be much less and figures for the fibre content of the bran may now reach 11·5 per cent, indicating about 18 per cent of endosperm.

TABLE 4

	Commercial bran%	Pure bran%
Moisture	12·5	12·5
Oil	4·7	8·3
N × 5·7	15·0	16·8
Ash	4·7	8·3
Fibre	7·9	14·0
Non-N material	55·2	40·0

Comparison of Tables 2 and 3 illustrates clearly the fact that meals of nominally the same extraction may have quite different fibre contents and hence different digestibilities. The same fact has emerged even more clearly in a survey of National wheatmeal[5].

Apart from the method of milling, the actual fibre content of the wheat mixture used must also be a factor. For individual wheats this may vary[4] from 1·7 to 2·9, with an average for a present-day grist of about 2 per cent.

With increasing extraction the digestibility of each extraction increment will depend upon the corresponding increase in fibre content. As a matter of interest, for the meals in Table 3 the digestibilities of the fractions 85–90 per cent, 90–95 per cent and 95–100 per cent are 50, 40 and 40 per cent respectively.

All the experimental fibre values quoted in this paper were determined by Mr. R. H. Carter by a modification of the official method which he has developed for wheatmeals; each value can be reproduced to within 0·05. We are also indebted to Squadron Leader T. F. Macrae for allowing us to see the typescript of the paper by him and his collaborators now in the press of the *Journal of Hygiene*, and to Dr. C. R. Jones for much helpful criticism.

[1] Macrae, T. F., Bacon, J. S. D., Hutchinson, J. C. D., and McDougall, I., *Chem. and Ind.*, **60**, No. 40, 723 (1941).

[2] Krebs, H. A., and Mellanby, K., *Lancet*, p. 3 (March 14, 1942).

[3] Newman, L. F., Robinson, G. W., Hainan, E. T., and Neville, H. A. D., *J. Hyg., Camb.*, **12**, 119 (1912). Rubner, M., quoted by Lusk, "Science of Nutrition" (Saunders & Co.). Royal Society Food (War) Committee, 1918.

[4] Booth, R. G., Carter, R. H., Jones, C. R., and Moran, T., *Chem. and Ind.*, **60**, No. 52, 903 (1941).

[5] Staff of Research Association of British Flour-Millers, NATURE, **149**, 460 (1942).

RADIATION FROM THE SUN

By DR. C. E. P. BROOKS

ALL weather, and all life, on the earth are derived ultimately from the sun, and knowledge of the radiation emitted from the sun may be regarded as one of the fundamental sciences. Most of our knowledge of this important subject has resulted from the work and enthusiasm of one man, Dr. C. G. Abbot, of the Astrophysical Observatory of the Smithsonian Institution, who has carried on the work for a generation in the face of many difficulties and much discouragement. The problem is indeed a difficult one, for between the sun and the earth is interposed the atmosphere, and the radiation which reaches the surface is weakened by absorption and scattering. Water vapour, dust, and to a less extent ozone are the worst enemies, and a large part of vol. 6 of the Annals of the Astrophysical Observatory is occupied in describing the continuous attempts to overcome them during the years 1931–1940*. What might have been an even less surmountable enemy, the financial one, has been vanquished mainly with the help of Mr. John A. Roebling.

The difficulties of observation are lessened by making observations at as high a level as possible, to diminish the thickness of the atmosphere traversed by the sun's rays, and in a dry climate to minimize the loss of observations by cloud and also the weakening of the radiation by water vapour. Further, since in spite of all precautions the effect of varying weather conditions cannot be entirely eliminated, several stations must be used distributed as widely as possible in both hemispheres. For the purposes of supply the stations must also be reasonably accessible. Dr. Abbot has sent out many expeditions to test promising localities, but in the present volume the observations from only three are utilized: Montezuma, at a height of 8,895 ft. in Chile, which is the best station; Table Mountain, California (7,500 ft.) and Mount St. Katherine, Egypt (8,500 ft.). Observations were also made for a number of years at Mount Harqua Hala in Arizona, but have not yet been worked up owing to instrumental difficulties, and at Mount Brukkaros in south-west Africa, which though almost cloudless, proved to be too dusty.

The object of the observations is to determine not only the average amount of solar radiation received at the limits of the earth's atmosphere, the so-called 'solar constant', but also its variations from day to day. Since these amount to little more than 1 per cent on either side of the mean (which is still set at 1·94 cal./cm.^{2}/min.) great precision is required both in observation and reduction. Precision in observation is obtained by the refinement of instruments. Direct measurements are made with Abbot's silver-disk pyrheliometer which serves as a permanent standard, and a modified form of Ångström's electrical pyrheliometer to give accuracy and speed in the daily observations. The loss by scattering is given by the pyranometer, which measures the brightness of the sky near the sun and hence the haziness of the air. These instruments give the total radiation falling on them, but since the radiation of different wave-lengths is differently weakened in its passage through the atmosphere, it is also necessary to obtain, with the bolometer, records of the whole

*Annals of the Astrophysical Observatory of the Smithsonian Institution. Vol. 6. By C. G. Abbot, L. B. Aldwich and W. H. Hoover. (Publication No. 3650.) Pp. viii + 207 + 7 plates. (Washington, D.C.: Smithsonian Institution, 1942.)

spectrum from infra-red to ultra-violet. These instruments are described and illustrated in Chapter 4, which then goes on to a detailed account of the technique of reduction. The principle is very simple; the higher the sun the less the thickness of the atmosphere traversed and the greater the radiation. Hence, if the state of the atmosphere remains unchanged, a series of observations at different hours, preferably in the morning, can be extrapolated to give the radiation at zero air-mass, that is, the 'solar constant'. In the full or 'long' method computations have to be carried out for about forty different wave-lengths, and even with the help of a special slide-rule they are laborious, but Dr. Abbot has been able to devise short cuts without appreciable loss of accuracy. The derivation of the 'short' method is described in detail but cannot be summarized here.

Dr. Abbot and his colleagues are continually improving their methods, and in order to maintain a homogeneous series of data, it was necessary to re-compute some of the earlier observations. This has now been done, and no less than seventy-eight pages of the report are occupied with the determinations for nearly every day from August 29, 1923, to September 29, 1939. The result is a series of "preferred" values of the solar constant, but even these are not always quite final. Some of the values show improbably large jumps from day to day, and these were checked by examination of the variations of the short-wave spectrum alone. If these gave more reasonable variations, the "preferred" values were adjusted accordingly, as a series of "improved preferred" values. Some of the resulting changes are relatively large, as much as 1 per cent, and this must to some extent impair confidence in the accuracy of the individual daily values. Dr. Abbot indeed admits as much. From a comparison of the results at three stations, he estimates the probable accidental error of a single daily value as only 0·16 per cent, but he expresses the view that only means of ten days or longer can be regarded as really reliable. Ten-day and monthly means are given from August 1920 to September 1939.

The last part of the volume is concerned with the periodogram analysis of these data. The method used is not described in detail but was apparently graphical; short periodicities were "disclosed" by inspection and removed, disclosing longer periodicities and so on. The method is dangerous, giving rather free play to preconceived ideas of the lengths to be expected, and since all those found are integral parts of 273 months, a check by rigid Fourier analysis would have been both simple and desirable. Dr. Abbot's objection to this is that none of the periodicities is of sine form. He gives an illustration of the determination of three periodicities, and remarks, "We think readers may not be too favourably impressed by the comparison of the 34-month periodicity". He is quite correct in the case of one reader at least; practically the whole of the amplitude found results from the enormous range of the first of the six waves shown. His justification is that the reconstructed curve agrees closely with the original; this claim would be legitimate if all the fourteen waves were of sine form, but is doubtfully so with the complicated forms shown, each of which could be expressed as the result of several sub-waves. The lengths determined range from 8·3 to 273 months; recurrences at intervals of twenty-seven days associated with the sun's mean rotation period are also illustrated and there is a tantalizing reference to the temporary existence of shorter periods measured in days. No relation is found between solar radiation and sunspot numbers.

The great future importance of the study of variations in the solar constant lies in its probable application to weather forecasting. Periodicity is the most obvious method of this application, for if the solar variations are truly periodic they should be reflected, in favourable circumstances, in periodicity of weather. From the point of view of the Astrophysical Observatory, however, this is only a by-product. Dr. Abbot casually mentions that he verified the lengths of the solar periodicities of 8–68 months in meteorological data for a hundred years for three stations (with due allowance for seasonal changes) and he claims two-thirds success for long-period rainfall forecasts, but until the relations between solar and terrestrial phenomena are more fully understood forecasts are probably premature. His great service still lies in the record itself rather than in its applications.

OBITUARIES

Prof. W. H. Young, F.R.S.

WILLIAM HENRY YOUNG, who died in Lausanne on July 7 when nearly eighty, was one of the mathematicians who had contributed most to the revival of English mathematics during the last fifty years.

Young was born in London on October 20, 1863; his family had worked in the City for some generations. His first education was at the City of London School: the headmaster, Abbott, had been a schoolfellow of his father. He went up to Cambridge, at Peterhouse, in 1881, was fourth Wrangler in 1884, and a fellow of his College from 1886 until 1892; in 1939 he was made an honorary fellow. In his early graduate years he did a great deal of teaching, both as a private coach (as was usual with Cambridge mathematicians then) and more officially as a lecturer at Girton. In 1896 he married Grace Chisholm, who had been one of his pupils and was also a fine mathematician. He was the first Hardinge professor of mathematics in Calcutta from 1913 until 1916, professor of the philosophy and history of mathematics in Liverpool from 1913 until 1919, and professor of pure mathematics in Aberystwyth from 1919 until 1923; but the first two of these chairs were rather 'occasional' appointments, and it is something of a scandal that he should never have occupied a regular position really worthy of a mathematician of his rank.

Young became a fellow of the Royal Society in 1907, and was Sylvester Medallist in 1928; was de Morgan Medallist of the London Mathematical Society in 1917, and president from 1922 until 1924; and president of that rather unhappy body, the International Union of Mathematicians, from 1929 until 1936. He leaves his wife and five children, two of whom are also well-known mathematicians.

Young wrote three books (two in collaboration with his wife) and about two hundred papers, all crowded into a little more than twenty years of his life; he was over forty when his first important papers were published. He belonged to the generation of mathematicians which includes Burnside, A. C. Dixon, Forsyth, Hobson, Love, and MacMahon, and was fully the equal of any of them in originality and power; but all of them had established their

reputations before he began, and this late start was a serious impediment in the way of his recognition. This was also delayed by a certain conservative hostility to the subjects which he represented, and which scarcely anyone in England understood.

'Complex' function-theory had been introduced to Cambridge a little before (in a rather ill-digested form) by Forsyth, but the 'real' theory was still practically unknown. Hobson and Young were the first true English 'analysts', and "The Theory of Sets of Points", published by the Youngs in 1906, the first real English book on analysis. This is a first-rate book both in substance and in presentation, and it is most regrettable that it should never have been rewritten, in the light of later advances, and reprinted. But all Young's books were comparatively unsuccessful in England. His Cambridge Tract, "The Fundamental Theorems of the Differential Calculus" (1910), though much of its content is now 'classical' and is reproduced in the standard French courses of analysis, never went into a second edition; and the joint "First Book of Geometry", a most interesting and original 'book for children', written in 1905, was 'a complete flop' at home, though it has been translated into four foreign languages.

The theory of functions of a real variable has been completely rewritten since 1900. The remaking began with Borel's famous monograph "Leçons sur la théorie des fonctions", published in 1898. Among those who have remade it Lebesgue, by general consent, stands first; but there is no one else who has contributed more than Young. Young's first work was independent of Lebesgue; he had found definitions of measure and integration different in form from, and in some ways more natural than, Lebesgue's, but equivalent in essentials. He was anticipated by some two years, and the disappointment was a blow; but he recognized the anticipation magnanimously—"the Lebesgue integral" is his own phrase—and set himself whole-heartedly to work at the fuller development of the theory: he was the first, for example, to find a really satisfactory synthesis of the work of Stieltjes and Lebesgue. But his interests were not at all confined to the theory of integration; there is scarcely a chapter of real function-theory on which he has not left his mark. Thus he rewrote a large chapter of the differential calculus, and the theory of Fourier series, and other orthogonal developments, are full of striking theorems discovered by Young.

G. H. HARDY.

Sir Alfred William Flux, C.B.

ALFRED WILLIAM FLUX, who died recently in Denmark, aged seventy-five, was successively mathematician, economist and statistician. Successively, because after being classed as one of the Jubilee Senior Wranglers in 1887, he came under the influence of Alfred Marshall (who had succeeded to the chair of political economy at Cambridge in 1885), was one of the foundation members of the Economic Society (1890), and from 1893 until 1908 was a teacher of economics, first at Manchester and then at McGill University, Montreal.

Flux's main interest was not in the development of the mathematical theory of economics, but in its practical applications to commerce from the statistical point of view. He had been elected a fellow of the Statistical Society in 1893. Though he joined the Econometric Society in 1934, he appears never to have used mathematics in his writings, except in his "Economic Principles" (1904), where, following Marshall, he gave them a subsidiary position. Indeed, he publicly deprecated mathematical tools except as a personal background to verbal analysis. In 1908 he returned to England and was attached to the Board of Trade until his retirement in 1932. During this period he was a very active participant in the work of the Royal Statistical Society, as member of council from 1908, honorary foreign secretary from 1925, and president during 1928–30. Soon after 1932 he made his home in Denmark, Lady Flux's native country, and during part of each year worked at the League of Nations in Geneva. The outbreak of war found him in Denmark.

Flux is best known because of his work on the British Censuses of Production. The first Census (1907) was already organized when he joined the Board of Trade, but he became director in 1911 and wrote the Final Report. He was responsible for the Censuses of 1911 and 1924 and for the initiation of that of 1930. Apart from the normal reports on production, he made three important developments. First he built up estimates of the total national income from the side of production, and contrasted and compared the results with earlier estimates based on the aggregate of individual incomes (Giffen's method); this analysis is of far-reaching importance (*J. Roy. Stat. Soc.*, 1913 and 1929). Secondly, he initiated an index of production, for which the Census provided the weights attached to the different quantity series (*J. Roy. Stat. Soc.*, 1927). Thirdly, he reconstituted Giffen's index of wholesale prices, again using the Census for weighting (*J. Roy. Stat. Soc.*, 1921). These results are now well known as the Board of Trade's Index-numbers of Production and of Wholesale Prices, though from time to time details have been modified.

The Board of Trade and its offshoot the Ministry of Labour have frequently been recruited from the ranks of trained economists who have brought wider views than are commonly taken by those without outside experience. This procedure has been abundantly justified by the importance and originality of the work which has here been too briefly summarized.

A. L. BOWLEY.

Dr. F. Dawtrey Drewitt

DR. FREDERIC GEORGE DAWTREY DREWITT, the biographer of Jenner and historian of the Chelsea Physic Garden, died at his home in Kensington after a long illness on July 29 at the age of ninety-four. He was educated at Winchester and Christ Church, Oxford, where he gained a second class in the School of Natural Science and received his medical training at St. George's Hospital. He qualified in 1876, and after being physician to the Victoria Hospital for Children during 1881–97 and at the West London Hospital during 1882–1902 he gave up medical practice for more congenial pursuits.

In 1903 Drewitt became a member of the British Ornithologists' Union, and afterwards served on the councils of the Zoological Society, the National Trust for Places of Interest or Beauty and the Society for the Promotion of Nature Reserves. He was best known, however, for his connexion with the Chelsea Physic Garden, on the board of management of which he had represented the Royal College of Physicians since 1921, and he was vice-chairman from 1929 until a few months before his death.

Drewitt's work entitled "The Romance of the Apothecaries Garden at Chelsea", which first appeared in 1922 and reached its third edition in 1928, contains a delightful account of the history of the Garden, including mention of the distinguished men connected with it, such as Sir Hans Sloane, Linnæus and Sir Joseph Banks, its most remarkable trees and other plants, and the present botanical research which is being carried out there. His further interest in botany is shown by a little book on the Latin names of common flowers, published in 1927. His "Life of Edward Jenner, Naturalist and Discoverer of Vaccination", of which the second edition was published in 1933, contains besides the description of the introduction of, and opposition to, vaccination, a lively account of Jenner's early life as a country practitioner and his observations on natural history. In 1931 Drewitt published for the first time "The Note-Book of Edward Jenner in the Possession of the Royal College of Physicians of London, with an Introduction on Jenner's Work as a Naturalist", in which he dealt with Jenner's friendship with John Hunter, Dean Buckland and Sir Humphry Davy. In addition to these works on natural history, Drewitt was the author of "Bombay in the Days of George IV: a Memoir of Chief Justice Sir Edward West", published in 1907.

There is no better example of the truth of Buffon's well-known aphorism than that given by Drewitt, whose polished and kindly nature was reflected in his style. His versatility was shown by his being an accomplished artist and twice exhibiting at the Royal Academy. He had many friends not only in the medical profession but also among laymen, the most notable of whom was Ruskin. He married in 1887 but left no issue. J. D. ROLLESTON.

WE regret to announce the following deaths:

Dr. Arnold Berliner, founder and formerly editor of *Die Naturwissenschaften*.

Mr. D. B. Mair, formerly assistant Civil Service Commissioner and a distinguished mathematician, on July 21, aged seventy-four.

Sir Allen Mawer, F.B.A., provost of University College, London, an authority on English place-names, on July 22, aged sixty-three.

Prof. John H. Salter, formerly professor of botany in the University College of Wales, Aberystwyth, known also for his work in ornithology, on August 5, aged eighty-one.

Prof. A. L. Selby, emeritus professor of physics in University College, Cardiff, on July 22, aged eighty-one.

Prof. R. Willstätter, For. Mem. R.S., formerly professor of chemistry in the University of Munich, on August 3, aged sixty-nine.

Sir Francis Younghusband, K.C.S.I., K.C.I.E., distinguished for his explorations in south-eastern Asia, on July 31, aged seventy-nine.

NEWS and VIEWS

Astronomy on Postage Stamps

THE dedication of the Mexican National Astrophysical Observatory at Tonanzintla in February last has been marked by the issue by the Mexican Government of a series of six postage stamps devoted entirely to astronomical subjects. The 2c., 5c., 10c., 20c. and 40c. stamps depict respectively the dark nebula in Orion, the solar corona as seen at a total eclipse, the open spiral nebula in Canes Venatici, the edge-on spiral nebula NGC 4594, showing absorption in the central plane, and the ring nebula in Lyra. The 1 peso stamp, departing from the principle of showing spectacular objects such as these, is an experiment which must surely be unique in philately; it depicts the Hertzsprung-Russell diagram connecting stellar luminosity with spectral type, with the main sequence, the giants, the supergiants and the white dwarfs all duly labelled. The significance of this diagram will certainly escape all but those fairly well grounded in astronomy, but the ordinary user of the stamps of lower denominations cannot fail to be impressed by the grandeur of the objects shown.

Functions of Works Managers

IN his speech in the House of Commons on July 22 on the work of the Factory Department of the Ministry of Labour and National Service, Mr. Ernest Bevin paid a well-deserved tribute to works managers. The works manager, he asserted, deserves more recognition than he had yet received, and the country owes much to him in this War, as well as to the mines manager, for overcoming problems which no Government department, scientific worker or technician could have foreseen. There is a very close understanding between the Factory Department and the works managers, who have much in common, being trained, to a very large extent from the same personnel and thus understanding not only each others' problems but each others' approach to the problems. He drew a distinction, which he thinks industry will have to face in the future, between what he called the working directorates who understand the actual operations of the job and he put these working directorates in the same category as works managers. He also emphasized the value of the newly established Factory and Welfare Board as a safeguard against rigid bureaucratic methods. It gives industry and public service a proper place in this branch of administration, and Mr. Bevin thinks that a board of this character will remain a permanent feature to enable us to surmount the changes and difficulties which will arise in our industrial system in the vexed and difficult times ahead. Referring to the Department's policy in encouraging the establishment of personnel managers in the larger factories, he believes that too much is often imposed on the works manager in receiving deputations and like matters and being expected to run the works as well. Much specialization is essential in handling such problems, and the personnel manager as part of the executive is a great asset in large works. Referring to hours of work, Mr. Bevin said that production and mobilization of manpower have now reached a point when matters can be tightened up in respect of hours of work, and the trend of his speech indicated a welcome determination to deal firmly with the question of excessive hours, which are so important a factor in absenteeism and in low production.

Cork Substitutes

As a result of the War, imports of cork have almost, if not entirely, ceased in various parts of the world. Consequently, ingenuity has had to be exercised in providing substitutes. For obvious reasons stoppers for bottles were one of the earliest articles for which replacement was required. One of the countries effected was India, where the imports of cork from Europe very soon ceased, and the need for a substitute material for use as stoppers in different types of bottles, and as liners for bottle crowns and so forth, became keenly felt. The Forest Research Institute at Dehra Dun took up the matter, as explained in a Leaflet No. 6, Utilisation ("Note on Some Experiments on Cork Substitutes", by Dr. N. Narayanamurti, J. N. Pande and D. C. Roy (Research Institute, Dehra Dun, 1941). Experiments were conducted on the production of corks made of wood, composition corks made of disintegrated tree barks and pith corks for hypodermic tabloid tubes. So far, experiments have shown the following suitable substitutes. Bottle stoppers: stoppers of *Cryptomeria japonica* wood suitably slotted and softened by chemical treatment; crown cork liners: composite cork made from *Erythrina suberosa* bark and bagasse fibre have been found suitable; corks for tabloid tubes: paraffin-impregnated sola pith is suitable. The methods of manufacture of these substitutes are described.

Nature Reserves Investigation Committee

A NATURE Reserves Investigation Committee has been established with the following membership: Sir Lawrence Chubb (chairman), Mr. G. Dent, Capt. C. Diver, Mr. J. C. F. Fryer, Mr. N. B. Kinnear, Prof. W. H. Pearsall, Dr. J. Ramsbottom, Prof. James Ritchie, Prof. E. J. Salisbury, Dr. G. F. Herbert Smith (honorary secretary), British Museum (Natural History), London, S.W.7.

The object of the Committee is to examine proposals for the establishment of nature reserves as part of any general scheme of national planning; and to obtain information from such bodies or persons as may be directly or indirectly concerned with the formation, organization, or administration of nature reserves or sanctuaries. In particular, the Committee will inquire into the types and approximate areas of reserves and sanctuaries which should be provided to ensure the preservation of communities or species; the species of plants and animals which are in danger unless special arrangements are made to secure their preservation and reproduction; the localities where such reserves and sanctuaries should be situated; the extent to which the public should have access to the various reserves; and the most appropriate methods for acquiring, financing and administering the reserves.

Scientific Film Conference

THE first Scientific Film Conference in Great Britain met in the County Buildings, Ayr, during August 1 and 2. In Ayrshire there are four scientific film societies in operation, while an Army and an Air Force camp also arrange periodic shows of scientific films. The Conference was attended by forty-three delegates appointed by the film societies, universities and technical colleges, research institutes, technical departments of local government bodies and the Association of Scientific Workers. Dr. Norman Wright, director of the Hannah Dairy Research Institute, Mr. Arthur Elton and Dr. Blodwen Lloyd presided at the three sessions held on August 1. The delegates decided to form a National Federation of Scientific Film Societies, which would co-ordinate the activities of a Scottish and an English association of such societies. The great need for the increased production and showing of good scientific films was stressed by Mr. Elton (Ministry of Information) during a symposium on "The Scientific Film", to which Miss Mary Field (Gaumont British), Dr. A. Clow (University of Aberdeen), Mr. Stewart Paterson (Ardrossan S.F.S.) and Dr. B. Lloyd (Glasgow S.F.S.), among others, contributed papers. There was general approval of a resolution that both the winning of the War and the planning of post-war reconstruction require the application of the scientific method, and that a wider understanding of this method could most readily be achieved through the medium of the film.

Library of the Philippines

COLONEL C. P. ROMULO, formerly a publisher in Manila, now aide-de-camp to General MacArthur, has reported in the *New York Herald-Tribune* of July 17 that the Japanese have destroyed by fire the Library of the Philippines at Manila. According to Colonel Romulo, the aim of this vandalism is to obliterate all reference to the United States and Great Britain and anything savouring of Anglo-Saxon culture and democracy. With this aim in view, the occupying forces have formed a Text-book Board comprising seven Japanese and three Filipinos, which is expected to see that no reference to the above countries or culture shall be available in schools. Colonel Romulo was awarded the Pulitzer Prize for 1941 for his interpretative articles on Japanese aims. It will be remembered that university buildings in Manila escaped damage during the attack on Manila (NATURE, July 4, p. 20), and it would appear that the destruction of the Library referred to above occurred after the Japanese occupation.

Bournville Village Trust

UNDER the title "Sixty Years of Planning: the Bournville Experiment", the trustees of the Bournville Village Trust have issued an admirable illustrated account of the development of Bournville from the building of the factory there by Richard and George Cadbury in 1879, when the first houses were also built to provide accommodation for those of the workmen who had to live near the factory (Bournville Village Trust, Birmingham 30). Bournville Village as we know it to-day dates from 1895, and the land and houses were transferred to an independent body, the Bournville Village Trust, when the success of the Bournville Estate seemed assured in 1900. The trust deed laid down the broad lines of future development, and this pamphlet shows the many sides of the work at Bournville in their true perspective. Housing schemes, the reconditioning of slum property and the planning of both municipal and private developments, as well as research into building and planning properties all find some mention in a book which is of real topical value apart from its historical aspect as a popular account of a great pioneer development. The illustrations of amenities, community activities, the planning of and provision for recreation, as well as for cultural needs, the treatment of transport and road problems and the preservation of the countryside show what is possible

with vision and forethought, and should give a further stimulus to that growing movement to use to the full the opportunities which the tragedies of war itself now afford us of rectifying the mistakes and failures of the past and our failure to plan harmoniously either the industrial towns or the countryside of Great Britain.

Indian Farming

THE journal *Indian Farming*, now in its third year of publication, is issued by the Imperial Council of Agricultural Research of India and is a praiseworthy attempt to bridge the gap between cultivator and scientific worker. It is a monthly with a pleasant appearance of format and is copiously illustrated. It includes articles on breeds of Indian livestock, livestock products and crops, and the erosion problem receives due recognition: Shorter articles and reviews from all parts of the country help to provide a reasonably full conspectus of Indian agricultural problems and of the manner in which technical effort is being directed to meet them. All original papers have a practical bias, as, for example, the recent paper entitled "More Light on the Red-spot Epidemic", by B. L. Chona and G. W. Padwick (**3**, 70–73; 1942). This gives details of the infection of sugar-cane by *Colletotrichum falcatum*, which has led to sudden and almost complete failure of the variety *Co* 213 over a wide area: a new strain of the fungus, not observed before the epidemic, is described. A note on animal quarantine in the Provinces and States discloses that the Central Provinces alone have anything like a comprehensive organization. As a good example of the educative article may be mentioned "Propagation of the Apple in Kumaun", by R. S. Singh. The solar treatment of loose smut of wheat—a method evolved at Lyallpur from Jensen's hot-water treatment—has been described by J. C. Luthra (**2**, 416; 1941); it is very effective and furnishes a striking instance of extreme simplicity in a control measure well adapted for farmers. A new heavy-yielding and strong-growing variety of sugar-cane (*Co* 421), described by Ch. Kh. Mohammad (**2**, 140; 1941), seems to be especially suited to the Punjab, and its seed is being multiplied as rapidly as possible. V. R. Rajagopalan (**2**, 136–39; 1942) has established calcium deficiency as the cause of an outbreak of non-bacterial abortion in equines. *Indian Farming* gives much attention to processing and marketing, including the canning and dairying industries, and the grading of eggs and oranges, and whenever possible simple devices adapted to Indian conditions are described in order that quality shall be improved.

Montesquieu and Medicine

THE issue of the bilingual *Schweizerische Medizinische Wochenschrift* of May 2 contains an article in French by Dr. Camille Dreyfus of Mulhouse on this subject, in which he declares that the author of "L'Esprit des Lois" and the "Lettres Persanes" deserves a place in the history of medicine which has not yet been accorded to him. In 1718, the Academy of Bordeaux, of which Montesquieu had been elected a member two years previously, had chosen as the subject of a prize "The use of the renal or atrabiliary capsules", the modern equivalent of which would be "The physiology of the suprarenal capsules". Montesquieu made a report on the essays submitted, in which he showed that none of the competitors was worthy of the prize, which was, therefore, not awarded. His "Observations sur l'Histoire Naturelle", which he submitted to the Academy in 1721, contained microscopical studies of the pigmentations of insects, the parasitic life of the mistletoe, the abdominal circulation of the frog, the foramen ovule and ductus Botalli and experimental researches on the nutrition value of vegetables. In spite of his satires on medical practitioners in "L'Esprit des Lois" and the "Lettres Persanes", it would be wrong to suppose that he was prejudiced against the medical profession generally. In a letter to his friend the Abbé de Guasco, he expressed his admiration and affection for Van Swieten, the celebrated Dutch physician, whom Maria Theresa had invited to Vienna to reorganize medical education. Montesquieu was also a friend of the Chevalier Louis de Jancourt, who contributed articles on physiology and pathology to the "Encyclopédie". The high esteem in which Montesquieu himself was held by a leading medical man of the time is shown by the following appreciation of him by Antoine Portal, the celebrated professor of anatomy at the Collège de France and the Jardin du Roy: "If Montesquieu had devoted himself to the study of anatomy he would perhaps have advanced this science as much as he did moral science." In conclusion, Dr. Dreyfus relates that Montesquieu was the author of a thought which alone should win him immortality: "If I knew something useful to my country but injurious to Europe and the human race, I should regard it as a crime."

American Health in Early War Months

ACCORDING to an editorial in the April issue of the *Statistical Bulletin*, the organ of the Metropolitan Life Insurance Company of New York, the United States have enjoyed a period of remarkably good health during the months they have been at war. An improvement in mortality-rate during the first three months of 1942 over that in 1941 was reported for almost all the important causes of death, and no less than nine diseases have shown death-rates lower than ever before. These diseases included not only typhoid fever, scarlet fever, diphtheria, whooping cough, syphilis and appendicitis, but also such important diseases as influenza, pneumonia and tuberculosis, in which the mortality has been low in recent years. The 1942 record for the most important diseases of middle and later life, namely, cancer, diabetes and cardiovascular renal diseases is favourable compared with that of 1941, the death-rate from diabetes being down 10 per cent and cancer and the cardiovascular renal diseases each 3 per cent. One of the few diseases to show a rise in 1942 as compared with 1941 are diseases of the puerperal state, of which the rate rose from 4·1 to 4·5 per 100,000, or approximately 10 per cent. It is probable that the increase was due to the rise in the birth-rate and in the number of women exposed to the risks of pregnancy and child-birth. Another group of conditions in which there has been an increase in the death-rate were external causes, with the exception of suicide, which had declined. Homicides and accidents, especially accidents due to motor-vehicles, were higher than in 1941. The war deaths reported to the Company in the first three months of 1942, amounting to 5 per 100,000, accounted for a part of the rise in the death-rate from external causes.

Concrete Simply Explained

THIS is the title of a booklet which has been published by the Society of Engineers (war-time address, 56 Church Street, Weybridge, Surrey) as reprinted from the *Transactions* of the Society. It was written primarily for the training of concrete operatives by Victor S. Wigmore, and presents the subject in a simple manner which should make it valuable to all grades of workers on the staff of contractors or engineers. The reader is asked to imagine that he is on a site where concreting is about to take place and he is then introduced in turn to each of the ingredients—cement, sand, coarse aggregate and water—and finally to different processes of concreting.

Each section has been treated very thoroughly and in considerable detail as, for example, in the section dealing with cement, where the reader is informed regarding the best method of storing the bags to keep them dry and to facilitate their progress to the mixers. The usual procedure of taking a sample for test, the tests applied, and the processes of setting, hardening and ripening are explained and some warnings given as to possible mistakes such as that of allowing aluminous cement and Portland cement to be mixed together. In a similarly thorough and practical manner the other ingredients and the work of concreting are described and explained. As, in the rebuilding of our towns after the War, concrete will play a very important part and there will be a demand for men who know how to make concrete of first-class quality, it is to be hoped that civil engineering contractors will distribute this booklet widely among their staffs and responsible workmen.

Variations of Geomagnetism

H. D. HARRADON, Department of Terrestrial Magnetism, Carnegie Institution of Washington, has given a short account of this subject (*Sky and Telescope*, 1, 8; June, 1942), commencing with the discovery of the secular variation by Henry Gellibrand in 1634—a discovery of considerable importance, especially for mariners. Since no observations are available prior to this date, attempts have been made to extend our knowledge of the earth's magnetism to earlier times by the study of the magnetization of eruptive rocks, baked clays and ancient potteries. In quite recent years magnetic data have been obtained from successive lava flows of Mount Etna, the assumption being that the lava retained the direction of the earth's magnetic field at the time of its solidification, but unfortunately the results have proved rather indefinite. More promising lines of research are found in the study of layers of Pleistocene clays from an old glacial lake near New Haven, Conn., and also of sediment taken from the floor of the Atlantic. In the latter case, where several thousand years of deposition were represented, there is the suggestion of a possible variation in direction of magnetization amounting to more than 60°—the greatest range in secular variation ever recorded. No theory up to the present has explained the mystery of these secular variations; they are probably connected with changes in the interior of the earth, regarding which there is mere speculation. The transient variations, among which the solar and lunar diurnal and the annual variations are the chief, are discussed, and a number of useful diagrams and charts illustrate the connexion between magnetic storms, auroral displays, sunspots, etc.

Horticultural Work on the Amaryllidaceae

VOL. 8 of *Herbertia*, the year-book for 1941 of the American Amaryllis Society (Pp. 180. Hamilton P. Traub (editor), Orlando, Florida), includes several short papers of scientific interest. W. M. James and F. T. Addicott have studied the causes of sterility in interspecific crosses within the genus Nerine, and find a possible explanation in the presence of extra chromosomes in some parents. There appears to be no correlation between chromosome numbers and flowering period, though there is a sharply marked geographical difference between early flowering species and later blooming kinds. J. Marion Shull shows that early flowering species of Hemerocallis have made their flower initials by the previous autumn, whereas later flowering kinds have no floral initiation at that time. "Food Manufacture and Flowering in the Daffodil", by Dr. John Grainger, relates climate, photosynthesis and flower formation. It is found that floral initiation begins when carbohydrate content of the bulb is maximal. The daffodil appears to provide a very efficient photosynthetic mechanism, and its carbohydrate is completely mobile. Optimum conditions for photosynthesis are provided by a high daily average of sunshine and a relatively low average temperature between 40° and 50° F. Albert W. Close directs attention to the use of sphagnum moss for the germination of seeds of difficult species, and the method has the advantage of almost eliminating the damping-off disease. Numerous shorter papers give information on various Amaryllid clones, their combination in breeding, and practical culture. The Society's score-card method for the horticultural evaluation of daylilies has been extended to Florida by John V. Watkins, Hamilton P. Traub and Wyndham Hayward.

Periodic Comet Forbes, 1929 ii

HARVARD College Observatory Card 626 announces that van Biesbroeck found this comet as a fifteenth magnitude object on a pair of plates exposed at the 24-in. reflector, Yerkes. Its position on 15 June ·34763d. was, R.A., 0h. 04m. 25·11s., Dec. – 4° 50′ 18·7″. The comet showed a short tail 1′ in length in position angle 270°. In the "Handbook of the British Astronomical Association", 1942, Mr. F. R. Cripps has given the elements of the orbit and also an ephemeris from which the object was easily found. Perihelion passage occurred only half a day earlier than was assumed.

Announcements

SIR HAROLD SCOTT, director of the Bureau of Hygiene and Tropical Medicine, is retiring on August 31. The Secretary of State for the Colonies has appointed Dr. C. Wilcocks, assistant director of the Bureau, to be acting director.

THE medical faculty of the University of Basle has conferred an honorary doctorate on Prof. Eugen Pittard, rector of the University of Geneva, on the occasion of his seventy-fifth birthday, in recognition of his services to anthropology.

DR. S. F. DOREY, chief engineer surveyor of Lloyd's Register of Shipping, will deliver the Parsons Memorial Lecture of the Institute of Marine Engineers on September 16. The lecture will be on "Reduction Gearing for Marine Steam Turbines", and will be delivered at the house of the Institution of Mechanical Engineers.

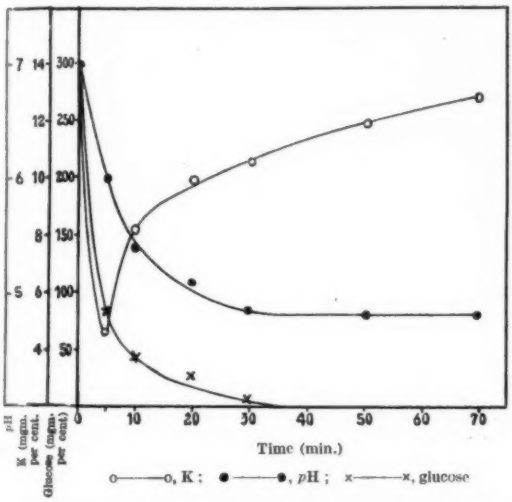
LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Potassium in Bacterial Fermentation

Verzar and Pulver[1] discovered that alcoholic fermentation by living yeast cells is accompanied by a striking shift of equilibrium between extracellular and intracellular potassium. The beginning of fermentation is marked by a vigorous intake of potassium from the surrounding medium. With the progress of fermentation the potassium is again liberated from the cells. No plausible explanation of this phenomenon has as yet been advanced.

It now appears that the 'potassium effect' is not confined to alcoholic fermentation by yeast but represents a general feature of glycolytic processes. We were able to demonstrate exactly the same phenomenon in the desmolysis of sugars (glucose, maltose) to lactic acid, hydrogen, etc., by *E. coli*. The accompanying table and diagram are representative of a series of experiments which yielded analogous results.



A suspension of *E. coli* in a solution of *M*/60 glucose, *M*/250 potassium chloride, *M*/30 (NaH_2PO_4-Na_2HPO_4), *p*H 7·05, was incubated at 41°; glucose and potassium were determined in samples drawn from the solution and cleared by centrifuging.

The intrinsic nature of the relationship between the 'potassium effect' and sugar metabolism in the bacteria is demonstrated by the following facts: (1) no such effect occurs when fermentable sugar is omitted from the phosphate-potassium chloride medium; (2) different experimental factors (temperature, *p*H, substrate concentration, aerobiosis or anaerobiosis) exert a parallel influence upon both fermentation-rate and potassium absorption.

Time (min.)	Glucose mgm./100 c.c.	Potassium mgm. 100 c.c.	*p*H
0	300	13·9	7·05
5	79	4·7	6·00
10	43	8·2	5·40
20	32	9·9	5·10
30	9	10·4	4·81
50	0	10·9	4·80
70	0	12·9	4·80
90	0	13·5	4·80
120	0	13·8	4·77

The first period of fermentation is marked by a rapid and steep decrease of potassium in the medium. Then the process is reversed, the absorbed potassium being gradually released. The initial conditions are restored simultaneously with, or shortly after, the end of fermentation. At the turning point of the process, that is, at the maximum potassium intake and the beginning of potassium release, the fermentation substrate is still far from exhausted and acid production is still vigorously continuing. Therefore it is clear that the absorption of potassium is connected with some initial phase of the reaction chain of fermentation.

During the brief period in which potassium absorption occurs, glucose disappears from the medium at a rate far exceeding its 'fermentation-rate', as measured by acid formation. This discrepancy in the reaction balance could be accounted for by the detection of the formation in the cells of a non-reducing, hydrolysable polysaccharide which disappears in later stages of fermentation. *The conversion of sugar into a polysaccharide in the initial stage of sugar desmolysis has thus been established by us for bacterial fermentation*, as it has been for alcoholic fermentation in yeast and for glycolysis in muscle by Willstätter and Rohdewald[2,3]. There is a close coincidence in time between the maximum of polysaccharide accumulation and the maximum of potassium absorption in the bacteria. It seems reasonable, therefore, to ascribe to potassium a specific function in the synthetic reaction with which fermentation begins.

A detailed report on this investigation will be given elsewhere.

J. LEIBOWITZ.
N. KUPERMINTZ.
Department of Hygiene and Bacteriology,
and
Chemistry Department,
Cancer Research Laboratories,
Hebrew University,
Jerusalem.
June 18.

[1] Verzar and Pulver, NATURE, **145**, 823 (1940).
[2,3] Willstätter and Rohdewald, *Z. physiol. Chem.*, **247**, 269 (1937); *Enzymologia*, **8**, 1 (1940).

Thio-Ureas as Goitrogenic Substances

AN attempt to isolate the goitrogenic substance present in rape seed[1,2] suggested the possibility of its being a derivative of this urea. Allyl thio-urea was therefore tested. Doses of 20 mgm. were given to rats daily by stomach tube for a period of eight weeks, after which the thyroids were examined. They had an average weight of 43 mgm., this being three to four times the normal weight. Histologically, the glands show extreme hypertrophy and hyperplasia, and almost complete loss of colloid. The administration of 50 mgm. daily by stomach tube, for ten days, produced identical histological changes in the thyroid, although the weight of the gland is not so great—average of 30 mgm. per 60 gm. body weight. This dose had no toxic effect. Preliminary

experiments with 200 mgm. of thio-urea daily for ten days have produced similar results. The changes in both thyroid and pituitary are similar to those produced by feeding rats a diet containing rape seed[2,3].

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June 8.

[1] Hercus, C. E., and Purves, H. D., *J. Hyg.* (Camb.) **36**, 182 (1936).
[2] Kennedy, T. H., and Purves, H. D., *Brit. J. Exp. Path.*, **22**, 241 (1941).
[3] Griesbach, W. E., *Brit. J. Exp. Path.*, **22**, 245 (1941).

Oxidation by Copper in Alcoholic Medium

NOT many examples of redox catalysis in non-aqueous solutions are known. The oxidation of ascorbic acid by copper in absolute ethyl alcohol is interesting because in many respects it resembles the corresponding oxidation in aqueous systems. In the experiments to be described, the absolute alcohol solution of ascorbic acid contained 1 mgm. of the acid per 2 ml. After the oxidation, the unchanged ascorbic acid was estimated by dichlorphenolindophenol titration of a 2 ml. sample diluted by addition of 10 ml. of 0·5 per cent aqueous acetic acid.

No data concerning the solubility of copper sulphate in absolute ethyl alcohol could be found in the available literature. This has been determined by weighing the anhydrous salt remaining after careful evaporation of a saturated alcoholic solution of copper sulphate. The solubility of $CuSO_4.5H_2O$ at 17° C. was found to be 0·0045 per cent, that of anhydrous $CuSO_4$, 0·009 per cent.

Salt dissolved	Conc. of $CuSO_4$	% Oxidation after 5 hr.	% Oxidation in the presence of $5·7 \times 10^{-3}$ NaCl after 5 hr.
$CuSO_4.5H_2O$	$1·9 \times 10^{-5}$ *M*	0	0
,, ,,	$9·5 \times 10^{-5}$ *M*	63·6	27·2
Anhydrous $CuSO_4$	$3·8 \times 10^{-5}$ *M*	40·9	0
,, ,,	$1·9 \times 10^{-4}$ *M*	100·0	45·4
Concentration of ascorbic acid $8·5^{e} \times 10^{-4}$ *M* in all cases.			

The catalytic action of copper sulphate is shown in the accompanying table. From this table also the inhibiting influence of sodium chloride can be seen. This influence is identical with the action of sodium chloride in aqueous systems.

Even greater than the activation of copper sulphate alone is that given by the pyridine-copper sulphate complex obtained by the action of pure pyridine on anhydrous copper sulphate and evaporation of the excess of pyridine. The crystalline salt so obtained was deep blue in colour and similar to salts obtained by Lang[1]. It contained $CuSO_4$ and pyridine in equimolar proportions. The solubility of this complex in absolute alcohol is 0·022 per cent, giving a greater amount of $CuSO_4$ in solution than did copper sulphate alone.

At a concentration of anhydrous copper sulphate of $8·04 \times 10^{-5}$, 35·7 per cent of ascorbic acid was oxidized during six hours; at a concentration of copper sulphate – pyridine complex corresponding to a $CuSO_4$ concentration of $9·06 \times 10^{-5}$, 100 per cent oxidation was found after 15 minutes.

Pyridine alone has also a catalytic effect, the concentration required to produce a given amount of oxidation being 1,000 times as great as that of copper sulphate.

It is noteworthy that these effects of pyridine and pyridine – copper sulphate complex in alcohol are quite different from those in aqueous systems, where pyridine alone (possibly by binding Cu) inhibits ascorbic acid oxidation, and the copper sulphate–pyridine complex is much less active than corresponding concentrations of copper sulphate alone.

Water present in alcoholic systems up to 1 per cent has no influence on the rate of oxidation. Higher percentages activate the oxidation, but this phenomenon is complicated by *p*H changes.

A full account of the work with the theoretical considerations will be published elsewhere.

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[1] Lang, W., *Berichte*, **21**, 1578 (1888).

Percentage of Water in Jelly-Fish

A LIVING specimen of *Aurelia aurita* about 4 in. in diameter was weighed by the displacement method[1] and the percentage of water found by distilling it under xylol[2]. The result was: water, 95·56 per cent; residue, 3·87 per cent; giving a difference of 0·57 per cent.

Since the distillation was carried out in what was practically a closed still, nothing should be lost. The difference, 0·57 per cent, represents (*a*) a trace of fat or other material dissolved by the xylol, and (*b*) a trace of water adhering to the rather large vessel which had to be used. The gonads would contain a trace of fat. The residue consists of salts, 3·2 per cent, leaving 0·67 per cent of dry protein; and since living material, such as muscle, in most marine animals, approximates to water 80 per cent and protein 15 per cent, we conclude that the 0·67 per cent of dry protein corresponds to about 4 per cent of protoplasm.

A number of distillations were carried out giving similar results, and it was intended to clinch the matter by carrying out a Kjeldahl estimation for nitrogen, but unfortunately no more living specimens arrived in the laboratory.

Some rather misleading statements have been made about Aurelia, and unfortunately these are finding their way into text-books. It has been stated that "The jelly-fish contains 99·8 per cent of water" and "The organic material in the body of medusæ amounts to less than 1 and most often to less than ½ per cent". Bateman[3] has criticized the first statement and shown it to be incorrect, but from theoretical grounds alone 99·8 per cent water is an impossible figure for Aurelia, for (*a*) an animal comprising 99·8 per cent water would float in the sea with a substantial portion of its body out of the water, which Aurelia does not do; (*b*) the density of Aurelia has been found, and it is obviously close to that of sea-water, which is 1·027 at 13° C. at Plymouth; if Aurelia were composed of 99·8 per cent water with a density of 0·99941, the density of the remaining 0·2 per cent would have to exceed that of mercury; (*c*) since Plymouth sea-water itself contains only 96·8 per cent of distilled water, surely this is the upper limit for any marine organism living in it.

We may conclude therefore that Aurelia comprises

about 96 per cent water, 3 per cent salts, a trace of fat varying with the state of the gonads, and about 4 per cent of protoplasm.

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[1] Lowndes, A. G., NATURE, **141**, 289 (1938).
[2] Lowndes, A. G., NATURE, **148**, 594 (1941).
[3] Bateman, J. B., "The Osmotic Properties of Medusae", *J. Exp. Biol.*, **9**, 124 (1932).

Check-list of British Birds

MR. SETON GORDON, in his review of a "Check-List of British Birds" in NATURE of July 11, 1942, p. 40, remarks that, according to Cameron of Lochiel, the last year the osprey bred on Loch Arkaig was in 1908, and not 1902 as given by Mr. Witherby. There seems, however, to be some confusion regarding these dates. I was at Achnacarry for ten months from October 1902, and in the spring of that year the eggs were taken by a man from Fort William, who swam out to the island where the nest was situated. To guard against that happening again, the present Lochiel's father instructed his forester to put barbed wire round the lower part of the tree, and this I helped him to do.

These precautions were, unfortunately, unnecessary, as only one osprey returned in 1903, and I first saw it on April 15. It remained about the Loch throughout the summer, and several times I watched it fishing, also bringing sticks to the old nest which, by the end of the season, was about a foot higher.

For how many years the single bird returned to Loch Arkaig I have no personal knowledge, but I have been told that the last time it was seen was in 1910.

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Regarding the above, Lochiel writes to me as follows:

"This shows the efficacy of the Secret Security Service set up by my father and continued by myself to keep the facts about the ospreys nesting absolutely *secret*. My father died in November 1905. We married in March 1906, and did not take up residence at Achnacarry until 1907, yet my wife remembers well seeing the ospreys and their nest on repeated occasions. As she was never at Achnacarry before we married and never saw an osprey in her life anywhere else, this surely is sufficient proof. Again, Norman MacRae (my piper and butler) also bears me out. He was never at Achnacarry before 1906 and his wife came to Achnacarry on October 31, 1907 (the ospreys always left before the end of September), yet they both remember the ospreys well, and going to see the nest. Mrs. MacRae, therefore, could not have seen them before the spring and summer of 1908. There is no possible doubt: the ospreys nested until the summer of 1908."

It is quite possible that, as Mr. Kinnear states, the osprey did not nest in 1903, but it is evident that they nested in the following years. Lochiel was living at Achnacarry and, as I know, always took a great interest in the birds, so it is inconceivable that both he and the witnesses he has quoted should be in error.

SETON GORDON.

Encouragement of Research in Industry

SIR LAWRENCE BRAGG says in NATURE of July 18, p. 75: "Lip service is paid to research because it is respectable and fashionable to do so, but responsible industrialists in private express their disappointment." That inventive talent is lacking seems doubtful. Even under conditions of complete detachment a continual flow of ideas cannot be maintained indefinitely; but when questions of plant, personnel, materials and time limit exist to cramp the style, a considerable proportion of the industrial scientist's fund of originality has to be transferred from the purely progressive to the task of adaptation to rapidly changing conditions. Provided the right men have been selected on the production side all is well; but if the research and development men are confronted with too much opposition to change, they will quickly become discouraged. It is, after all, their job to make improvements.

As to whether industrialists provide the right sort of conditions, it would probably be true to say that, on the whole, industrialists do not quite understand the research man, stand to some extent in awe of him, and thus fail in part to stimulate "the flow . . . of fundamental ideas which would profoundly affect our industries". The director of a few years ago who, showing a visitor round his works, stopped and asked of one of his research chemists: "Well, my man, and what have you discovered to-day?", is not entirely extinct. But probably the root of the problem lies in the delegation of insufficient responsibility to research workers, even long after these have 'found their feet'. The suppression of executive ability in men of proved research capacity is surely to be deplored in many cases. Latent powers should be allowed for in men in harness, lest they remain too much in grooves.

It may help certain types of inventive genius to be assisted by a limited number of persons entirely devoid of original thought. These should be selected for their ability to interpret the wishes and record the ideas. To some extent they also act as a foil, but their importance is none the less on that account.

The industrialist who has not enjoyed a scientific training must find it hard to grasp the enormously dynamic nature of original research, or, when he sees frenzied activity over some apparently trivial matter, wonders whether sufficient eye is being kept on the main chance. Bearing in mind that 'spontaneous' research is bound to flow more readily than 'research to order', the time allowed for the latter should be on the liberal side. To some extent the research worker should be definitely encouraged to develop sidelines which spontaneously arise, as so much time would be wasted if at a later date he were asked to develop just that feature from scratch. It would be gratifying to think that research was sufficiently treasured in Great Britain to ensure facilities for developing what might be termed the 'overflow' of ideas of scientific workers engaged on specific products of research. Just as in chemical plants, 'waste' is frequently utilized to produce marketable by-products.

In many respects scientific workers themselves would get on faster if only they spent a small fraction of their time in striving each week for some improvement in their department. When actually engaged on research, they covet a lack of interruption. Then why not plan to be 'not available' at certain hours of each day? An interrupted train of thought may

mean ideas lost for good under present-day hectic conditions. It is, then, in the industrialist's interest to come to an understanding, so far as practicable, with his scientific personnel, on mutual intercourse. The use of a typist should by no means be restricted to purely clerical work. How many of Wordsworth's gems would have been lost to posterity were it not for sister Dorothea capturing the flowing words. If typists are not denied to directors and if poets find them useful, then surely the research scientist while manipulating should be encouraged to declaim his readings, his observations, his trains of thought to a shorthand typist seated within unobtrusive earshot.

Finally, it is possible that when engaged on pressing priority work, men will be tempted to work so fast that their readings are not properly recorded. This tendency to relapse into scrap-of-paper habits should be resisted firmly. One never knows when the story as a whole may not be wanted.

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Science and Education

SCIENCE in relation to education has been prominent in NATURE for many months, but one aspect of the matter seems to me to deserve more attention: the social and historical setting of science. Sir Richard Gregory said[1]: "One reason why few men of science care to take an active part in politics, is that they do not feel able to effect [such] a transfer of their trained habits of thought" to the consideration of social and political problems. It certainly seems true that very few men of science can effect this transfer; nearly always judgment is heavily influenced by some bias, necessarily subjective. Moreover, this applies equally to men of letters, to men of business, to men in every walk of life. Therefore, we must think, not only of fitting the scientific man to play a conscious part in history, but also of giving the scientific outlook to the historian and the classic. When these men of the 'humanities' view social development with the same critical objectivity as the scientific man, they will be less likely to misguide us. The historian particularly needs the scientific attitude; for example, it is incredible that H. A. L. Fisher could write in 1936 ("History of Europe", p. 1207) on Hitlerite Germany: "Some items, such as the Second Punic War with England and the war of revenge on France, are no longer regarded as likely to be remunerative. Far more promising as a means of augmenting the territory of the Third Reich is the expedient of the plebiscite."

Now, I suggest that the inability of the man of science to carry his trained habits of thought into other fields, and the entire lack of the scientific attitude on the part of others, is due to the isolation of the several subjects in the schools during the formative years. The error of the schools is not that they give too much time to any one subject, but that they fail to integrate them all into a single whole. How can this be remedied? The progress of science is contained in the advance of history, and itself helps to shape that advance, affecting every branch of human culture. On this ground I make the following suggestions: (1) The approach to science should be historical, the fundamental principles being studied in their historical order, against a background of contemporary social development. Apart from the basic reason for this, any branch of science becomes more real, and so more interesting and educative, if studied in this way. (2) To effect the above there must be complete correlation between the science class, the history class, the literature class, etc., the several syllabuses being planned as parts of one whole, bringing out the mutual actions between the various forms of social activity, in such a way that the student applies the scientific method of thought to all his studies. (3) Modern ideas on science, not always more difficult to understand than the concepts of classical science, should be included, impressing on the student that no theory, however well established it may seem, can be final. (4) Science must be understood to extend beyond the confines of physics, chemistry and biology, to embrace all social phenomena, involving the introduction of elementary instruction on statistics. In the study of human behaviour, the student should acquire the same attitude of mind as in his study of physical or chemical phenomena; theory must be tested by experience, both in the continuum of social history and the laboratory.

There should be no difficulty in finding time for such a programme, if it be recognized that the achievement is not to be a vast store of factual knowledge, but an understanding of principles and methods, and appreciation of the part played by science in shaping human society, and the ability to find factual knowledge when it is required. Least of all should we move towards vocational teaching in the primary or secondary school.

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[1] NATURE, March 7, 1942, p. 261.

Prof. A. R. Forsyth

MAY I correct Prof. Chapman on two minor points (NATURE, **150**, 49; 1942)? Forsyth's Calcutta lectures, published in 1914, were on the theory of functions of two complex variables. His treatise on differential geometry, published in 1912, that is, before he went to Calcutta, is described in the preface as consisting of the substance of lectures delivered during his tenure of the Sadlerian professorship at Cambridge. In his retirement Forsyth produced, not two treatises, but three, the third, which appeared in two volumes in 1935 with the somewhat misleading title of "Intrinsic Geometry of Ideal Space", being an extension to n dimensions of the analysis which for three dimensions and for four had been developed in earlier works.

I would not impertinently praise Prof. Whittaker, but as I am writing I should like to express the indebtedness of all for his masterly discussion of the decline of Forsyth's reputation. We all know that fifty years ago Forsyth's name stood internationally for English pure mathematics; we needed to be told that it stood worthily.

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RESEARCH ITEMS

Rice Field Insects

AN interesting Circular, No. 632, under this title by W. A. Douglas and J. W. Ingram, has been issued by the United States Department of Agriculture (Washington, D.C., 1942) which should prove of interest outside the United States. "Insect enemies of the rice crop differ", say the authors, "somewhat from those of other field crops and the methods of controlling them are different, because the rice fields are kept flooded with water during most of the growing period." Insect damage to growing rice is caused mainly by four species: the rice stinkbug (*Solubea pugnax*), two species of lepidopterous stalk borers (*Diatræa saccharalis* and *Chilo plejadellus*) and the sugar-cane beetle (*Euetheola rugiceps*). There are other insects capable of inflicting some damage if the conditions of their environment become eminently favourable, but these four are of chief importance. The stinkbug sucks the contents from the developing rice grain, causing a total loss of all grains so attacked in an early stage of their development. The stalk-borers feed within the rice stalk, resulting in the loss by death of the developing rice panicle. The adult sugar-cane beetle gnaws young rice plants prior to the flooding in the spring, and newly emerged adults attack the nearby mature stalks when the field is drained prior to harvest; the stalks fall over and are thus prevented from being picked up by the harvesting machinery. All the important insects attacking rice in the field are alluded to but the above four are fully described and methods for their control are given. This circular makes its appearance at an opportune moment—since the rice crops of the United States and India must be of the first importance to the Allied Nations.

Hatching of Eggs

PARTRIDGES and grouse usually hatch 100 per cent of their eggs whereas domestic fowls frequently only hatch 75–90 per cent. R. K. Cole has discovered one reason for a reduced proportion of hatched eggs (*J. Hered.*, **33**, 83–86; 1942). A lethal gene—talpid—was found in pedigrees of fowls showing infertility of a proportion of the eggs. Talpid causes the embryo to develop in an extremely abnormal manner. Most talpid embryos die about the eighth day of incubation, but a few may survive until the seventeenth day. The lethal gene is known to have been in the stocks of hens at Cornell for at least eight years.

Genetics of Natural Population

Linanthus Parryæ is a diminutive annual member of the Polemoniaceæ. It is found in the Mojave Desert of California, and has white or blue flowers. The numbers of the annuals vary considerably from year to year according to the amount of rain in the desert. In the locality studied by C. Epling and T. H. Dobzhansky (*Genetics*, **27**, 317; 1942) the population can be considered an isolated one. Sampling of 427 stations, each half a mile apart, was made and involved 126,100 plants. A total of 113,955 white- and 12,145 blue-flowered plants were found, but the distribution of the two types was not uniform. Indeed only 108 blue plants were found outside three distinct and separate areas. A typical *U*-shaped curve of the frequencies of blue-flowered plants in the sub-populations indicates that small size of population is the chief contributory cause of the irregular proportion of blue- and white-flowered plants in the sub-divisions of the area.

A Cancerous Neoplasm of Plants

PHILIP R. WHITE described "A Cancerous Neoplasm of Plants Produced by Autonomous Bacteria-free Crown-Gall Tissue" in a paper read before the American Philosophical Society on April 24. Cancer is characteristically an independent and unrestrained, unphysiological, invasive, and malignant growth. Primary crown galls of plants possess to a marked degree the last four of these characteristics. They cannot, however, be considered independent, since they are caused by a bacterium, *Phytomonas tumebaciens*. Nevertheless, on certain hosts, especially among the Compositæ, there occur in many cases of crown-gall infection secondary tumours of unknown etiology arising at a considerable distance from the point of inoculation. Work carried out within the past two years has shown that tissues derived from these secondary tumours are bacteria-free by both bacteriological and serological tests. Tissues from the interior of secondary tumours have been isolated and grown *in vitro* for more than a year. In tissue culture they grow much more rapidly and in a much less organized manner than do tissue cultures taken from non-tumorous tissues. These tissue cultures can be grafted into either sunflower or artichoke plants, where they produce typical crown-gall tumours. Gall tissue can be transplanted from sunflower to artichoke and vice versa. In both hosts, as well as *in vitro*, they retain their characteristic independent, unrestrained and unphysiological manner of development. Their invasiveness is restricted by the rigid skeletal framework in which plant cells are regularly constrained to function, and their malignancy is likewise restricted by structural characteristics of plants. Nevertheless, it is believed that the cells of these tumours and of the tissue cultures derived from and giving rise to them, possess all the essential characteristics of cancer cells and therefore represent a new and potentially useful material on which to study the etiology of cancer.

Auriculas

THE neat growth and pleasing flower colour of garden auriculas result from some interesting structural mechanisms, which are discussed in a short paper by Sir Rowland Biffen (*J. Roy. Hort. Soc.*, **67**, Pt. 6, June, 1942). Beautiful variations in flower colour are caused by the combinations of several factors—an imperial yellow colour, an anthocyanin (hirsutin), a buff yellow colour, and a white ground. Presence or absence of wax or 'meal' in the centre of the corolla also makes an additional contribution, while green, grey and white-edged forms are brought about by the plants' occasional demonstration of the foliar nature of the corolla lobes. Green-edged and grey-edged flowers occasionally occur on the same plant, and when this happens, the former spring from the base of the plant, while the terminal flower is grey-edged. A curious factor results from the presence of a 'paste' in the centre of some flowers, and there is evidence that this is a further indication of the leafy origin of the corolla. Chlorophyll may also occur in sections of the corolla other than at the edge. Zoned flowers thus arise, and another mutation gives striped flowers. The interactions of all these and other factors are discussed in the paper.

New Types of *Datura Stramonium*

Albert F. Blakeslee and A. G. Avery described "Nine Strikingly Diverse Types in *Datura Stramonium* with Location of their Determiners in a Single Chromosome" in a paper before the American Philosophical Society on April 24. The mutant characters discussed show wide departures from the normal type. One which has smooth, in distinction from spiny, fruits, has been classified as a distinct species, *Datura inermis*, although it differs from normals by only a single gene. This gene causes many changes beside the elimination of spines on fruits, such as shortening and thickening of petioles and internodes, increased inequality in paired branches, broadening of leaves, flattening of stigma and delayed fruiting. A type with short flowers and broad leaves is indistinguishable from another type which is determined by a different gene in another chromosome. A type which wilts in sunlight also mimics two other types brought about by different genes. One type induces early fruiting. A type has been called 'sickly' because its appearance resembles the effects of a virus disease or the environmental influence of lack of certain elements in the soil. One type usually branches with three, instead of two, forks but the environment affects the forking since plants which are genetically 3-forked occasionally have only two forks and normal plants may sometimes show three forks without being able to transmit the character to their offspring. One type brings about doubling of the chromosome number in eggs and pollen, one the production of lobed instead of round pollen grains and one causes the early death of the pollen grains affected without injuring the egg cells. By the breeding behaviour when extra chromosomes are present and by linkages between the characters in their inheritance, it has been shown that these nine types are determined by genes located in the 11·12 chromosome and at least eight of them in the ·12 half. It has been further possible by these methods to establish the approximate order and position of these genes within the chromosome.

The Lewiston-Auburn, Maine Earthquake of March 8, 1942

THIS earthquake has been investigated by William H. Weeks, *S.J.*, of the Observatory of Weston College, Massachusetts (*Earthquake Notes*, **14**, No. 4; April 1942). The data used were the seismograms obtained at the observatory at Weston College, together with the returned questionnaire cards supplied by the United States Coast and Geodetic Survey, with which the epicentral region was canvassed. At Lewiston, near to which the greatest intensity was attained, small objects and vases were overturned and a few dishes broken. This indicates intensity IV on the Rossi-Forel scale. The sound which accompanied the earthquake was like "snow falling from a roof". The shock was registered on the seismograms at Weston at 23h. 38m. 32s. U.T. and appeared to come from an epicentre some 128 miles north-east by north of Weston. From all the data the epicentre appears to have been near latitude 44° 10′ N., longitude 70° 14′ W., which is about nine miles north-west of Lewiston, and the origin time 23h. 37m. 59s. U.T. Captain Heck notes that this district had not been entirely free from earthquakes during the last three hundred years, and that an earthquake disturbed approximately the same area on February 5, 1929.

Order in the Alloy Cu_3Au

ELECTRON diffraction by the transmission method has been applied by L. H. Germer, F. E. Haworth and J. J. Lander (*Phys. Rev.*, **61**, 614; 1942) to investigate superstructure as produced in the alloy Cu_3Au by various heat treatments. One of the purposes of the work was to extend the field of usefulness of electron diffraction by applying it to material which has been studied for many years by means of X-rays. The customary limitation of electron diffraction to the study of surface phenomena only is believed to be unjustified. Cu_3Au was chosen because it still presents unsolved problems in spite of many years study, because in the superlattice which is formed the copper and gold atoms can readily be distinguished by their widely different scattering powers and because the alloy is fairly resistant to corrosion. The changes up to 560° C. have been studied in detail. There seems to be no sudden change in the diffraction pattern corresponding to the alleged Curie point of order. The methods developed in the research are suggested as applicable to other alloys and to mixtures of metal salts.

Active Nitrogen

Two more papers in the series by Lord Rayleigh on active nitrogen have appeared (*Proc. Roy. Soc.*, A, **180**, 123 and 140; 1942). From the experiments reported in the first paper, it is clear that the behaviour of the glass walls is very complex. Traces of oxygen or other impurities affect primarily the walls of the vessel and not the phenomena in the gas space. By a special device it is shown that when the behaviour of the gas is studied away from any surface, purest nitrogen is the best, and no favourable effect in promoting the active nitrogen phenomena is produced by adding a trace of oxygen. The second paper deals with the ionization associated with afterglowing nitrogen. It is found that this ionization is completely cut off if the testing vessel is separated from the after-glow by a silica wall. The ionization cannot therefore be directly produced by light within the range from λ 1850 to the visible. No increased current is observed when the surface action of the active gas is so vigorous as to make the testing cathode, of gold, red hot.

Stress Systems in Aeolotropic Plates

THE stress distributors in an infinite plate containing a circular hole are greatly modified when the plate is no longer isotropic. A. E. Green continues the theoretical solution of such problems as may arise when a rivet is driven into a hole and pulled sideways (*Proc. Roy. Soc.*, A, **180**, 173; 1942). The aeolotropic plate is assumed to have two mutually perpendicular directions of symmetry. Some examples of stress distributions are included which have non-zero force resultants on the edge of the hole, corresponding to cases in isotropic materials for which the solution is dependent on Poisson's ratio. The use of the complex variable makes the method of solution comparatively simple, and as an introduction to the work for an aeolotropic material the same method is applied to problems of stresses in an isotropic plate containing a circular hole in order to obtain results which Bicksley (*Phil. Trans.*, A, 227, 383) previously found by another method. Numerical work is carried out using the elastic constants found in experiments with specimens cut from the highly aeolotropic materials, spruce and oak.

EARTHQUAKES IN THE UNITED STATES DURING 1939*

A BOOKLET recently issued by the United States Coast and Geodetic Survey, entitled "United States Earthquakes, 1939", contains a very full account of the seismological activities of the department during 1939, together with a complete summary of the major results obtained. An important feature of the work is that it is fully co-operative with all interested in seismology, including the Weather Bureau, the Jesuit Seismological Association at St. Louis, universities, engineering companies, insurance companies and like commercial concerns, Science Service at Washington, the Seismological Society of America and interested individuals.

First come the non-instrumental results, chiefly obtained by the return of questionnaire cards by voluntary observers to local centres. This work is now fully systematized, and exceedingly useful results are obtained. In the booklet there is first a summary of the earthquakes according to the States concerned, the list including Alaska, Hawaiian Islands, Panama Canal Zone, the Philippine Islands and Puerto Rico. There follows a more detailed list classified by regions, dates, and the intensities of the shocks according to the modified Mercalli intensity scale of 1931. From this work it appears that the destructive and near destructive earthquakes of the United States during 1939 happened mostly in four large regions, which may be identified with (1) California, (2) the Appalachian Mountain region from near Chattanooga to near Boston, thence at right angles towards Montreal, (3) near the Mississippi–Ohio junction close to the rivers between St. Louis, Louisville and Memphis, and (4) the heights of the Rocky Mountains. Additionally, there were scattered epicentres throughout the country, probably the greatest being the one near Charleston.

Several universities and institutions send their seismograms and seismogram readings to the U.S. Coast and Geodetic Survey, and these are checked and printed along with the results obtained from the Survey's own teleseismic instruments. Altogether twenty-two observatories are involved in this way. From these readings along with those contributed by the Jesuit Seismological Association and others interested, epicentres throughout the world are calculated. In the publication under notice a complete list of such epicentres is printed for the years 1938 and 1939. Many of these have been mentioned previously in the columns of NATURE.

In order to furnish data suitable for the use of engineers, architects and others interested in the design of earthquake-resisting structures, the Survey instituted in 1932 a programme of strong-motion seismograph work. This makes use of seismographs placed in areas particularly susceptible to earthquakes, the seismographs being so designed that they only begin recording when the motion becomes sufficiently pronounced, and so that they are not unhinged by earthquakes such as are likely to occur (NATURE, Nov. 8, 1941, p. 551). The records obtained are interpreted on the assumption that the motion is simple harmonic, and the details published for each prominent pulse on each seismogram are: (1) earth wave period, (2) maximum acceleration, and (3) maximum displacement, together with remarks pertinent to the wave. During 1939, eight such earthquakes produced good strong-motion results. These were as follows: (1) Imperial Valley earthquake of March 21, which was recorded on the accelerograph at El Centro, some 24 miles N. 7° E. of the epicentre, the record showing a maximum acceleration on the horizontal component of about 26 cm./sec.^{2}. (2) Imperial Valley earthquake of March 24, showing details similar to (1) above. (3) San Diego County earthquake of May 1, recorded on the accelerograph at San Diego some 53 miles N. 23° E. of epicentre, with a maximum acceleration of about 3 cm./sec.^{2} on the north-south component. (4) Earthquake of May 4 near Boulder Dam recorded on the three accelerographs at Boulder Dam some four miles approximately N. 72° E. of the epicentre. The accelerograms here show the short-period motions characteristic of local earthquakes, the maximum acceleration being about 43 cm./sec.^{2} on the vertical component at the intake tower. (5) Western Nevada earthquake of May 11. This was recorded on the accelerograph at Hawthorne, Nevada, which is about 42 miles S. 85° W. of the epicentre, the maximum acceleration being about 8 cm./sec.^{2} on the horizontal components. (6) Northern Californian earthquake of June 22, with an epicentre off Cape Mendocino and recorded on the accelerograph at Ferndale. The maximum acceleration was about 15 cm./sec.^{2} on the south-west component. (7) San Diego County earthquake of June 24, which was recorded on the accelerograph at San Diego some 53 miles N. 23° E. of the epicentre. The motion on the accelerogram was somewhat irregular, the maximum acceleration being about 5 cm./sec.^{2} on the north-south component. (8) Southern California earthquake of December 27 with epicentre near Long Beach. This was recorded on the accelerographs at Long Beach, Vernon, Los Angeles Chamber of Commerce, Los Angeles Subway Terminal, and Hollywood, and on the displacement meter at Los Angeles Subway Terminal. At Long Beach, some three miles S. 75° W. of the epicentre, the maximum acceleration was about 14 cm./sec.^{2} on the east-west component. At Vernon, some fifteen miles N. 16° W. of the epicentre, the maximum acceleration was about 9 cm./sec.^{2}. At the Los Angeles Chamber of Commerce, some nineteen miles N. 22° W. of the epicentre, both the basement and the 11th floor accelerograms show irregular motion on the horizontal components, while the vertical components show a number of waves with 0·15 sec. period. At the Los Angeles Subway Terminal, about twenty miles N. 20° W. of the epicentre, the basement accelerogram and displacement meter records show small activity of an irregular character except on the vertical accelerogram. The 13th floor accelerogram shows considerably more motion, irregular on the south-west component, but comparatively regular on the others. At the Hollywood Storage Co., about 24 miles N. 29° W. of the epicentre, the seismograph on the adjoining lot and that in the basement of the storage building agree in showing slight motion of irregular character. The motion recorded in the penthouse is stronger and of comparatively long period, and is rather irregular except on the east-west component, which shows a maximum acceleration of about 3 cm./sec.^{2}. Several tracings of the accelerograph records are figured in the text. Maps with isoseismals are also given for the important earthquakes during the year.

During 1939, three tiltmeters were kept in operation on the grounds of the University of California at

* "United States Earthquakes, 1939", by Ralph R. Bodle. (Washington, D.C.: Government Printing Office.) 20 cents.

Berkeley with the active co-operation of the Seismological Station at that institution (Prof. Perry Byerly). Two required visible readings but a third automatically recorded pictures of the interferometer fringes every hour. No outstanding tilts could be associated with local earthquake activity. From October 1938 until January 1939 a triangulation resurvey was made of certain monuments in the locality between Petaluma and Point Reyes, California, originally established in 1928; about fifty stations were occupied. It is intended that periodic re-observations of this scheme will be made so that knowledge of possible earth movements may be obtained.

No tidal disturbances of seismic origin were noted on the gauges of the Bureau and co-operating stations during the year. One earthquake was reported felt by a vessel of the Coast and Geodetic Survey. This was on August 19 at Dutch Harbour, Alaska. Those aboard the ship felt four or five jolts.

ENTRY OF YOUTH INTO INDUSTRY

THE importance attached to the welfare of youth was reflected in the recent debate in the House of Commons on the Education Estimates; few of the many aspects of reconstruction problems after the War are more vital than that concerned with the welfare of youth. The memorandum on the problems of post-war entry of juveniles into employment, prepared by the London Regional Advisory Council for Juvenile Employment and recently submitted to the Ministry of Labour and National Service, emphasizes a vital aspect of juvenile welfare to which Political and Economic Planning directed attention in an admirable report, "The Entrance to Industry", so long ago as 1935. The memorandum adds little to what is contained in that report, but its arguments are ably reiterated. They are still valid, for while some progress has been made in regard to the provision of the social services required, we have scarcely begun to implement the long-term programme envisaged in the P E P report. Any charter of youth that may be promulgated will fail of its purpose if it does not receive the fullest consideration of all that is implied in the vital question of entry into employment. The plea of the London Regional Advisory Council that the economic aspect of the life of youth should not be neglected in the midst of educational, social, athletic or other preoccupations is indeed opportune.

Recalling the recommendation of the Malcolm Committee that education, whatever form it takes, should be related to the needs and circumstances of life, which for a vast majority of boys and girls means life spent in industry or commerce, the memorandum suggests that training for life implies a preparation for citizenship in the broadest sense, and that such training should be an integral part of the life of the school and of the curriculum in extension of work done in earlier services, the whole method and practice being linked with material services, such as fine school buildings, physical and recreative work, music, free meals, and also with the other social services. There should be an attempt in the last period of this portion of school life to ease the transition from school to the larger world outside through the creation of a club atmosphere, accompanied by corresponding modification of the curriculum.

While occupational guidance might be given in the schools by specially qualified teachers, no attempt should be made at direct training for livelihood except in schools directly concerned with technical training. In regard to part-time schools, the memorandum emphasizes that the main function is to continue the general education of the pupils, particularly in the broad aspects of citizenship; also that if the day continuation system is to be well and truly established, it must receive the wholehearted support of employers. It is to be hoped that the social conscience will finally reject the notion that if the young worker wants continuative education, it is his own business to seek it in the evening after a full day's work.

The particular difficulty which the small employer and small working unit present in this respect is recognized, as are those inherent in reconciling the claims of industry and education. The Council suggests that the position of the young person in industry should be regarded from the broad point of view of entry into employment, conceived as a continuous process moving by degrees from school life, through the sphere of youthful work, into the wider world of adult labour. It suggests the extension of the school medical service for the physical well-being of all minors, or at least medical examination so as to ensure that all juveniles are physically suited to enter the employment of their choice. Welfare work in industry should be closely related to the true needs of young workers; and to correct the excessive tendency to enter clerical occupations rather than trades the memorandum advocates the establishment of vocational training schemes based on expert sifting and guidance and the closest liaison with those responsible for apprenticeship.

The memorandum touches on a number of points in war-time experience such as the Essential Work Order, which may contain elements of permanent value for juveniles, and it directs special attention to three sections of the field common to education and industry of which little is heard: the need for a new outlook on the whole question of apprenticeship; the need for greater mobility of labour to meet unexpected changes in economic organization and location of industry; and the need for ensuring that those who have entered employment as 'learners', in the widest sense of the term, shall be equipped with that degree of adaptability which will enable them to meet the demand of any sudden turnover to new materials or fundamental revision of technique, as, for example, the changes which are bound to come as a result of the ever-increasing use of synthetic materials. These are questions of increasing significance, and it is essential that education and industry should work closely together in this field if the problems arising from them are to be solved. While deprecating pressure for too rapid development after the War, the Council would welcome and support any scheme calculated to secure the growth of a sympathetic understanding by teachers and educational administrators of the needs and problems of business and industry, and it is urged that such mutual relations should be fostered and encouraged.

The problem of youth in industry is essentially a question of entry into employment. The employer must consider the position of his young employees as an integral element in his management and organization. This will require the closest liaison and fullest co-operation between associations of employers and the trade unions to raise the entry

into employment of juveniles to the status of industrial relationship. At the same time, education authorities must face the realities of the economic world which the juvenile will enter or has recently entered. The day continuation school may become a real meeting-ground between the two worlds of education and industry if it is administered, not merely as an educational service, but also as a means of recovery and refreshment for the young worker. Until, however, the problem of entry into employment is tackled by all concerned as part of industry as a whole, all elaborations of the machinery of choice of employment and vocational guidance will be vain and its products largely a matter of hazard.

HOUSEHOLD LIGHTING, HEATING AND VENTILATION

PAPERS read at two of the series of twelve meetings of the Royal Society of Arts recently devoted to "The Post-War Home: Its Interior and Exterior", have now been published (*J. Roy. Soc. Arts*, June 26). R. Fitzmaurice, principal scientific officer at the Building Research Station of the Department of Scientific and Industrial Research, gave a lecture on the lighting, heating and ventilation of the ordinary house. Many facts of topical interest relating to domestic use of fuel and power were included. Non-functional design of working kitchens leads to needless waste of lighting. Plans are reproduced of the distribution of daylight in ill- and in well-designed kitchens using the same ground-plan with redistribution of the same areas of glass in the walls.

All three subjects are intimately related. Large window areas or windows opened for ventilation may lead to excessive use of fuel for heating. It is estimated that about half the total quantity of coal raised in Great Britain is used for providing warmth in buildings, the remaining half being used for power and heat in industry. Although Germany has a colder winter and maintains better heating conditions in buildings, the consumption of coal for heating per head of the population is considerably less than in Great Britain. Less use of open fires and increased use of smokeless fuel help economy. From a graph reproduced it is shown that in the last forty years the price of coal in London has more than doubled.

The very variable nature of the British climate is an obstacle to the use of some highly efficient heating systems. For example, in the United States, Germany and the U.S.S.R. centralized heating of a whole district from a single boiler house is practicable. It is well known that large plants need to work as nearly as possible to their capacity to obtain a high order of running efficiency. In Great Britain, however, an installation capable of handling the heating load during our relatively limited cold weather would not be running nearly to its capacity over the greater part of the heating season.

Contributions to the discussion included one by R. Grierson, of the Northmet Power Company, who gave details for the small house. The lowest amount spent per year for heating services—coke, coal, gas and electricity—is about £7–£8 a year. The ordinary clerk or member of the lower-paid professional classes spends £15–£20 per year. Mr. Grierson gave full details for his own house, where £28–£30 a year is spent in heating its 12,000 cubic feet of space. For windows, a glass area of about 20 per cent of the floor area under normal conditions gives adequate natural lighting. A ratio of 12½ per cent makes a room definitely too dull.

The common type of German stove "is not a thing of beauty, but it does make for efficiency (45–70 per cent) and reduces the amount of heat energy lost up the chimney. If the Englishman gets 20 per cent of the heat energy of the coal into the room, that is to say, if he gets 12*s.* worth of heat out of £3 worth of coal, he is fortunate". In view of the national requirements in the economical use of fuel, these figures give food for thought.

A serious difficulty lies in the fact that the initial expense of the more efficient heating devices in a home is always greater than that of the inefficient. Similarly, a further wastage occurs in cheap roofing of houses. After the War of 1914–18, many cheap houses were built with roofs of tiles on laths. No lining of felt or other material under the tiles was used. As a result, the wind blows right through the loft space, the water in the cold storage tank is frozen in the cold weather, and the bedrooms are separated from an atmosphere which during last winter fell in temperature to 14° F., by about three quarters of an inch of lath and plaster ceiling. Such rooms—similar conditions also occur in living-rooms in cheap bungalows—are in effect fitted with panel-cooling; for it is found that on a hot day, if the temperature of the ceiling is only 10° F. below that of the room, the cooling effect is most marked.

Mr. A. F. Dufton, also from the Building Research Station, found that a gas fire, designed to burn 0·2 therm an hour (5–8 kw.), had to be used for two hours in all in order to warm a room for half an hour for breakfast, so long as the walls remained in their original condition, consisting of plaster and wall-paper. When, however, the heat absorption of the walls was reduced by lining them with wood panelling, half an hour of previous heating instead of the original one and a half hours sufficed.

The eleventh lecture in the series was given by Miss Helen Masters, who dealt with equipment and maintenance in the kitchen. While the heat requirements for cooking are here again of great importance, many other factors are involved. The mere accumulation of labour-saving devices, without organization of the work to be done, will not promote efficiency. Architects have sometimes given so much attention to reducing the number of steps to be taken in walking from one part of the kitchen to another that they have designed kitchens which are too small to work in at all.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES

ANNUAL CONGRESS

THE South-Eastern Union of Scientific Societies held its forty-seventh annual congress at Guildford on July 25, a single day of sessions and excursions attended by seventy representatives and members.

A representative assembly to transact the business of the seventy constituent societies was held in the County School for Girls, at which Dr. J. Ramsbottom,

keeper of botany at the British Museum (Natural History) was elected president of the Union for 1942–43; in recent years he has served the Union as president of the Botanical Section. The new treasurer is Sir Gordon Hearn.

"Fungi and the Biology of Man" was the title of Dr. Ramsbottom's presidential address. He stated the facts concerning struggle and survival in fungi, the existence of races and their immutability, parasitism and symbiosis in outline: points of similarity and of contrast in man were indicated. Man does not inherit acquired characters in a biological sense, but he is heir to every other change. No pure races of man exist and the theory of race and blood is nonsense. Competition or struggle is universal, but in symbiosis an equilibrium has been attained. Competition in modern man is, for the most part, sociological and not biological. The State is an organization and not an organism. War between States is not a biological necessity nor is it transcendental. Man has his full complement of biological characters at birth: they are immutable. His ideas, his theories, his wishes are developed through culture: they can be changed and therein lie the hopes of civilization.

At the sectional sessions the following papers were read: "Historic London under Fire", by E. Yates, who exhibited the deplorable damage to medieval buildings caused by enemy action; "Studies in the Variation of Native Plants", by Dr. A. R. Clapham, who advocated co-operation by botanical societies for the proposed new Biological Flora of the British Isles (*J. Brit. Ecol. Soc.*, 356; 1941); "Constructional Elements in the Physiography of the Southern Counties of England", by F. Owen Whitaker; "Spiders and their Life History and Habits", by E. A. Robins, who described a spider new to the British list, *Marinda aurantia*, the golden garden spider of America.

In the afternoon, Dr. W. St. Lawrence Finny, the retiring president, conducted a perambulation visiting and describing the history of St. Mary's Church, Guildford Castle and Museum, the Guildhall and its regalia and the Abbot's Hospital of 1619. Botanists visited the Compton district; geologists the Guildford brickworks and the Lower Greensand beds at Compton. It had been suggested that this Congress should be at Haslemere but, this being impracticable, the zoologists went there by train to see exhibits arranged in the Haslemere Educational Museum. There was a special exhibit of native flowers arranged by the Guildford Natural History Society, the officers of which organized local arrangements, and it was pleasing to see flowering specimens of our ancient woad, *Isatis tinctoria* L., now classed in most Floras as "a casual alien". T. DANNREUTHER.

THE ONTARIO RESEARCH FOUNDATION*

THE report of the Ontario Research Foundation for the year 1941 includes the report of the Director, the audited financial statement and a list of publications issued to December 31, 1941. During the year the work of the Foundation has been increasingly concerned with problems associated directly or indirectly with the War, and owing to the nature of much of the work in this field, as well as on problems of civilian production arising out of war-time restrictions on supplies of all kinds, a detailed reference to much of the work is not possible. The creation of centralized inspection laboratories has relieved the staff of much of the work in organizing and conducting laboratory work on behalf of the Inspector-General, but the securing and training for effective service of young graduates and technicians is a serious problem, although problems associated with personnel have been considerably reduced by the help of the local Registrar for Military Service. The quick and effective results which follow from full co-operation between men with long experience in industry and a scientific group actively engaged in research on the processes and materials of the industry have been demonstrated, and although it is clear that relations with industry require further development, the Director suggests that problems of the post-war period will afford a further opportunity for economical and effective work along these lines.

In the Department of Biochemistry, the Leather Laboratory has been used to varying extents by the Department of National Defence and the Inspector-General, and work on Service specifications has been continued in collaboration with the National Research Council. Preliminary tests have been made of a modified abrasion-testing machine for leather, and the production of organic acids from sugar by chemical and microbiological methods has continued. Methods for crude and refined lactic acid are now in use on a commercial scale in Toronto. A good deal of time has been devoted to a careful comparison of chemical and microbiological methods for determining the vitamin B_1 content of foodstuffs, including bread. In the Department of Agriculture, the Pathological Laboratory has investigated the infection of small experimental animals with *Ascaris lumbricoides*, and the same Department has now completed the greater part of its field work on the climate and main soil types of southern Ontario, and in co-operation with the Federal Department of Entomology has made a rapid survey of southern Ontario to determine the location and extent of nematode infection in oats.

In the Textile Department a reasonable balance has been maintained between testing, short-term problems and more fundamental research, and an investigation has been undertaken on the treatment of various synthetic fibres to overcome the serious drawback that they cannot be given a high degree of twist in their natural state without serious troubles developing in the knitting operation, and encouraging results have been obtained in collaboration with the Dominion Silk Mills, Ltd. Partly successful attempts have been made to obtain new products for processing wools from raw materials which are and will be available in Canada.

In the Department of Chemistry, the organic and metallurgical analytical laboratories have continued to operate on behalf of the Inspector-General and there has been a marked increase in the number of problems submitted by outside firms. The Gas Laboratory has given several months to the study of steaming of horizontal retorts at one of the plants of the Consumers' Gas Company, and in the Department of Metallurgy gauge-testing, heat-treatment, physical testing and metallography services have been available to Government departments and manufacturers, and the long-term research programme has largely been brought to a standstill.

* Ontario Research Foundation. Report for the Year 1941. Pp. 25. (Ottawa, 1942.)

AUTOMOBILE RESEARCH

A CONSIDERABLE amount of the work at the Research Laboratories of the Institution of Automobile Engineers is being done for Government departments, and since it is of a confidential nature may not be shown to a visitor. Nevertheless, at the recent inspection of the laboratories by members of the Automobile Research Committee and representatives of affiliated firms, there were several important investigations to be seen in actual operation. Usually, work of this nature arises directly out of the problems of the industry either in the form of an explicit question such as that of the fatigue strength of crankshafts, or from the more nebulous query as to whether aeration of the lubricant is a determining factor in the cause of bearing troubles, and these two cases are representative of the work being done at the Institution's Laboratory.

Three investigations into the aeration and frothing of lubricants were to be seen in operation on the above occasion. In the Chemical Laboratory, tests were being made to ascertain the frothing tendency of different oils at atmospheric pressure but variable temperature. In the Chassis Laboratory, a transparent bearing of plastic material has been arranged so that the behaviour of aerated oil can be observed, and it was of interest to note that, under the limited conditions permissible, the oil film at the pressure side was not ruptured. In the General Laboratory, a typical installation comprising a tank, aero-engine sump, oil cooler, pumps and filters has been set up in order to study the effect of high altitudes on the frothing occurring in an aircraft engine lubricating system. It is intended to run this at reduced pressures and to observe the amounts of froth formed in different parts of the system.

An investigation of a somewhat related character is that on the durability and wear of bearings, for which machines of two types have been developed. In these the test bearings are in the form of bushes cast or inserted in a steel shell and fitted as the big end of a connecting rod. As an extension of the work on these two machines, tests on full-size engine bearings are in prospect on another machine of special design by which an alternating load is applied by an external lever arrangement. This machine is in the experimental stage, and it was particularly interesting to observe the electric strain gauge developed for measuring the actual load applied to the bearing and the torsionmeter for the cyclic torque variation. Both measurements are made while the machine is in operation.

Fatigue tests on full-size crankshafts are carried on in machines which are arranged so that one throw alone is under test at a time, thus enabling a number of separate investigations to be carried out on one multi-throw shaft. The machines are of the constant-strain type, and the method of test involves the repeated application of a known deflexion to the crank under test. Piston-ring scuffing is being studied in a single-cylinder water-cooled engine, arranged so that the jacket temperature and quantity of lubricant supplied can be varied under control. A gas producer of the Government "Emergency" type is being used to supply gas to a converted petrol engine in an investigation to ascertain the power loss involved in the conversion, and the methods by which this loss can be made good.

In addition to such work as is described above, the Laboratory staff is actively engaged in the preparation and circulation of abstracts of current technical literature bearing on matters affecting the automobile industry. Inquiries for technical information are dealt with by the library staff; the library contains a valuable collection of text-books, periodicals, pamphlets, research reports and reference volumes, thus providing the basis for the information service which supplements the research work of the Committee.

EARTHQUAKE ACTIVITY IN NEW ZEALAND

AN earthquake of considerable intensity shook the southern part of the North Island of New Zealand at approximately 11.35 a.m. local time on August 2. The epicentre of the shock was considered in New Zealand to have been some fifty miles from Wellington. The country districts most affected were Manawatu and Wairarapa, where the damage was considerable, though not on the same scale as at Wellington. The shock was estimated to have been as severe as that on June 24 (NATURE, July 4, pp. 18–19) though, according to human perception, it was of shorter duration. During the June earthquake damage was done to post office and power lines and water supplies, and many buildings were cracked. During the August shock hundreds of chimneys fell, many windows were broken and several of the buildings damaged in June were so severely shaken that it is likely they will have to be demolished. Some streets were temporarily closed to traffic and the City Engineer estimated that the damage in Wellington may run into hundreds of thousands of pounds.

The Dominion Observatory at Wellington has just (1942) published Bulletin No. *S*-64, "The Seismicity of New Zealand", by R. C. Hayes, which divides the islands into four seismic zones having marked differences in seismicity. Bastings has stated that the seismicity of New Zealand as a whole is high compared with other countries, due mainly to the relatively large number of earthquakes of the semi-destructive type. The seismicity of any region is governed by both the maximum intensity of the shocks which occur and the frequency of the earthquakes. In the work of Hayes, the relative seismicity is obtained by multiplying the average number of shocks per decade (1835–1940) in the area of Rossi-Forel intensity 10 by 10, the average of intensity 9 by 2, and adding these to the average number of intensity 8. Freeman's work had previously shown that earthquakes of R.F. intensity 9 are twice as destructive as those of intensity 8, and those of intensity 10 are ten times as destructive as those of intensity 8.

The average number of earthquakes per year (1921–40) is considered separately. Whenever earthquake swarms such as that in the Taupo region in the latter half of 1922 occur, only the stronger ones have been considered. On these facts, the four regions are: (I) The northern half of South Island and the south-eastern half of North Island with Cook Strait in the centre. This has an average of 97·8 earthquakes per year, and a relative seismicity of 11·5; (II) the central portion of North Island, average 23·0 earthquakes per year and relative seismicity 1·1; (III) the whole of the southern half of South Island, average 12·1 per year and relative

seismicity 0·1; (IV) the extreme northern tip of North Island, average 1·1 earthquakes per year and relative seismicity 0·0. In region I, the strongest shocks tend to congregate towards the east and south-east though the north-western part has the highest frequency for moderate or small shocks. The difference may be due to differences in the strength of crustal materials. In region II Taranaki is liable to semi-destructive shocks at infrequent intervals, "near" Auckland may have had violent shocks during 1835–36, and New Plymouth in 1819. In region III one semi-destructive shock between Mount Cook and Lake Wanaka has been definitely recorded though heavy shocks in the west coast sounds area have been mentioned in 1792, 1810 and 1826–27.

Earthquakes within about 10° of Wellington during May 1942 numbered 12. The greatest had intensity 4 (Rossi-Forel) on May 10, near Whakatane, and one on May 27 may have had intensity 3 at Upper Takaka. Two shocks on May 7 and May 21 respectively were felt at Rotorua. Additionally, five distant earthquakes were registered by the seismographs at Wellington, Christchurch, Auckland and Arapuni according to the provisional Bulletin *P*-123 published by the Dominion Observatory at Wellington.

ORIGIN OF COSMIC RAYS

A NEW hypothesis of the origin of cosmic rays and reports on its experimental testing in India and elsewhere are published in the *Physical Review* (61, 397 and 407; 1942) by R. A. Millikan, H. V. Neher and W. H. Pickering. While retaining the fundamental basis of nuclear physics theories and transformations of rest mass into other forms of energy, former suggestions are reversed. The sun's heat is assumed to correspond with atom building going on in its interior, whereas cosmic rays are due to the complete annihilation process going on in interstellar space. The transformation of the rest mass of the atoms into cosmic-ray energy is postulated as *complete* instead of partial.

When the postulates are used, five definite cosmic-ray bands are predicted, each reaching the earth in a particular latitude, and four plateaux of unchanging cosmic-ray intensity, these plateaux being delineated by the latitudes of entrance of the successive bands. The bands are named as (i) a silicon band of energy 13·2 Bev., (ii) an oxygen-nitrogen band of mean energy 7·1 Bev., (iii) a carbon band of energy 5·6 Bev. and (iv) a helium band of energy 1·9 Bev.

To test these predictions it was necessary to measure directly *vertical* incoming cosmic-ray energies as a function of latitude. India is the most suitable place in the world for the most significant of the tests. While in India it takes 17 billion-volt, vertical, charged-particle rays to break through the blocking effect of the earth's magnetic field at the equator, about 13 billion only suffice on the other side of the earth in Peru.

A comparison of theory and experiment was made possible largely through generous support of the research by the Carnegie Corporation of New York, the Carnegie Institution of Washington and the India Meteorological Service. The results so far attained are the detection of the silicon band and the joint nitrogen-oxygen band, with less definite observation of the carbon and the helium bands. The predicted values for latitudes and order of intensity are approximately of the same value as the observed. At least three of the four plateaux of constant cosmic-ray intensity were observed.

In the second paper, by Neher and Pickering, experimental details are given, although full description of the apparatus appears in the *Review of Scientific Instruments* under the title "A Cosmic-Ray Radio Guide" (13, 143; 1942). This instrument is a miniature radio-transmitter recording barometric pressure and atmospheric temperatures as well as the Geiger counter observations. By its aid, Geiger counter and electroscope observations were compared. The counter was found to give results very close to those of the electroscope and of comparable accuracy. When two or more counters are arranged as a cosmic-ray telescope, the radiation from a selected part of the sky only is recorded. Thus the energies recorded are delimited with considerably greater accuracy than by the use of the electroscope.

FORTHCOMING EVENTS

Tuesday, August 25

INSTITUTION OF CIVIL ENGINEERS (at Great George Street, Westminster, London, S.W.1), at 2.30 p.m.—Conference on "Civil Engineers and the Building Industry" (to be opened by Prof. C. E. Inglis, F.R.S.).

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

ASSISTANT TO THE ADVISORY OFFICER IN PLANT HUSBANDRY, and an ASSISTANT LECTURER IN THE DEPARTMENT OF BACTERIOLOGY—The Secretary, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow (August 28).

ASSISTANT TO THE CHIEF RESEARCH OFFICER OF THE MENTAL DISEASE RESEARCH DEPARTMENT—The Secretary, The University, Birmingham (September 1).

UNIVERSITY CHAIR OF CHEMISTRY, tenable at the Royal Cancer Hospital—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (September 1).

PHYSICAL CHEMIST AND A MINERALOGIST OR GEO-CHEMIST FOR RESEARCH WORK INTO MATERIALS AND PROCESSES OF THE CERAMIC INDUSTRIES—The Director of Research, British Pottery Research Association, Queens Road, Penkhull, Stoke-on-Trent.

GRADUATE (MAN OR WOMAN) IN SCIENCE or equivalent in Engineering, and a GRADUATE (MAN OR WOMAN) IN SCIENCE including Biology, and able to assist in General Subjects, at the Mexborough Schofield Technical College—Mr. E. B. Stockdale, Education Office, Mexborough, Yorks.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Reports of the Council and Auditors of the Zoological Society of London for the Year 1941. Pp. 38. (London: Zoological Society of London.) [58

Proceedings of the Royal Society of Edinburgh. Section B (Biology), Vol. 61, Part 3, No. 22: Deficiency Effects of Ultra-violet Light in *Drosophila melanogaster*. By Dr. B. M. Slizynski. Pp. 297–315. (Edinburgh and London: Oliver and Boyd.) 1*s.* 6*d.* [58

Other Countries

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